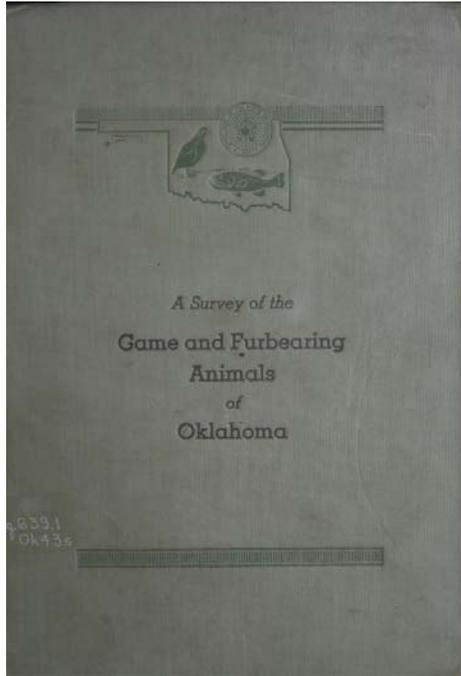


A Survey of the Game and Furbearing Animals of Oklahoma
By L.G. Duck, Director and Jack B. Fletcher, Biologist
Division of Wildlife Restoration and Research
Oklahoma Game and Fish Commission,
State of Oklahoma
(Pittman-Robertson Series No. II State Bulletin No. 3)



Introduction:

By Rich Fuller, Sr. Information & Education Specialist, ODWC

Beginning in 1938, teams of biologists and other Oklahoma Department of Game and Fish employees embarked on a landmark survey across the entire state. The objective of the survey was not only to document the state's flora and fauna, but also to determine the condition of Oklahoma's animals and plants after the state's worst ecological disaster - the "Dust Bowl."

The work would span four years and the comprehensive survey results would be published within two products, the first a 144-page book, entitled A Survey of the Game and Furbearing Animals of Oklahoma and secondly, a large colorful map entitled, A Game Type Map of Oklahoma-1943 showing fifteen different ecological regions of the state based upon vegetation types. The co-authors of both the book and the map were Oklahoma Game and Fish Biologists, Lester G. Duck and Jack B. Fletcher.



Lester G. Duck
(1912-1970)



Jack B. Fletcher
(1916-1984)

Assisted by many OGF biologists, game wardens and volunteers, Duck coordinated the survey in the western half of the state from his home in Mooreland, while Fletcher oversaw activities in the eastern part of the state from his home in Stilwell.

Today, both their book and map are extremely well-known among Oklahoma's biological scientists working for government agencies and/or colleges or universities. In fact, their book is more commonly known simply as "Duck & Fletcher" and similarly, the map is known as the "Duck & Fletcher Map of Oklahoma."

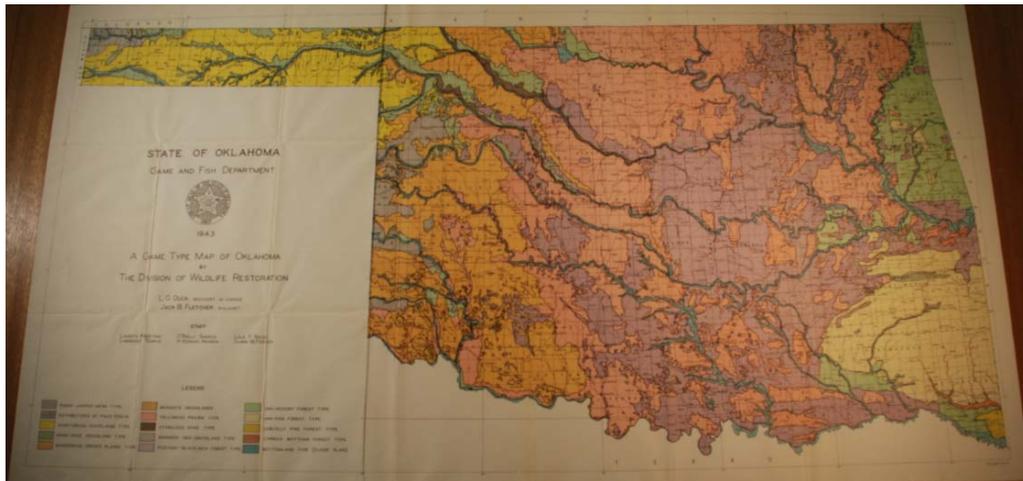


Photo: One of the few original (1943 prints) of Duck & Fletcher's Map in existence. The map is 58 inches wide X 30 inches vertically, and is on permanent display within the Oklahoma Department of Wildlife Conservation's Lake Arcadia Conservation Education and Training Center near Edmond, OK

For their incredible accuracy, simplicity, beauty and the fact that they were the first of their kind, these two documents are arguably the most important and prolific published works of biological research ever produced in Oklahoma. They continue to serve as a baseline for which ecological changes can be monitored since the 1940s. Additionally for many, Duck and Fletcher's map and book is not only the first, but also the best recognition of Oklahoma's incredible biodiversity – the most diverse non-coastal state in the U.S.

In 2010, producers with “Outdoor Oklahoma” television show produced an award-winning documentary on the landmark work of Lester Duck and Jack Fletcher, entitled “A Baseline of Diversity – The Duck & Fletcher Story.” Additionally, an article with the same title, was produced for Outdoor Oklahoma magazine in the Jan./Feb. 2011 issue available for download at the following link:

[Jan/Feb. 2011 Baseline of Diversity](#)

Editor’s Note: Juanita Mahaffey – recognized by co-authors, Duck & Fletcher

Within the Acknowledgement of Duck and Fletcher’s book, they thank Miss Juanita Mahaffey for her help in research as well as editing the final copy of the book. According to JoAnn (Duck) Teter (pers. comm.), her father Lester G. Duck gave significant credit to Mahaffey for her writing expertise and assistance in editing the manuscript for A Survey of the Game and Furbearing Animals of Oklahoma. Incidentally, it was Mahaffey who in 1945 would establish the Department’s monthly magazine, *Game and Fish News*, the predecessor to today’s *Outdoor Oklahoma* magazine published bimonthly by the Oklahoma Department of Wildlife Conservation.



Juanita Mahaffey
(1909-1987)

Mahaffey would eventually be promoted to the Department’s Chief of Information & Education Division- the first woman to hold such a position among fish and wildlife agencies around the nation. Mahaffey is regarded as a pioneer for women in conservation and was not only a founding member of the Association for Conservation Information, but also served a term as President of that organization. She retired from the agency in 1958 after 30 years of service and moved to Washington D.C. to work in public relations for the Environmental Protection Agency until she retired in 1971.



A Survey of the
Game and Furbearing
Animals
of
Oklahoma

q639.1
Ok43s

96 39.1 OKLAHOMA LIBRARY COMMISSION
OK 43c TRAVELING LIBRARY

1393~1

OKLAHOMA LIBRARY COMMISSION
TRAVELING LIBRARY

139E-1

139E-1

To all the "Some Fish" Guys
John Duck Letter
April 20, 2012

To All Wildlife Employees
Jack Blake Fletcher, Jr.

9639
OK 4

A SURVEY
OF THE
GAME AND FURBEARING
ANIMALS
OF OKLAHOMA

— By —

L. G. DUCK, Director

JACK B. FLETCHER, Biologist

Division of Wildlife Restoration and Research
Oklahoma Game and Fish Commission
State of Oklahoma

139 C21

OKLAHOMA LIBRARY COMMISSION
TRAVELING LIBRARY

Funds for the investigation included here were provided under various projects financed through the Federal Aid to Wildlife Restoration Act, and carried to conclusion by the Oklahoma Game and Fish Commission.

SOUTHWESTERN STATIONERY & BANK SUPPLY
PONCA CITY LAWTON
OKLAHOMA

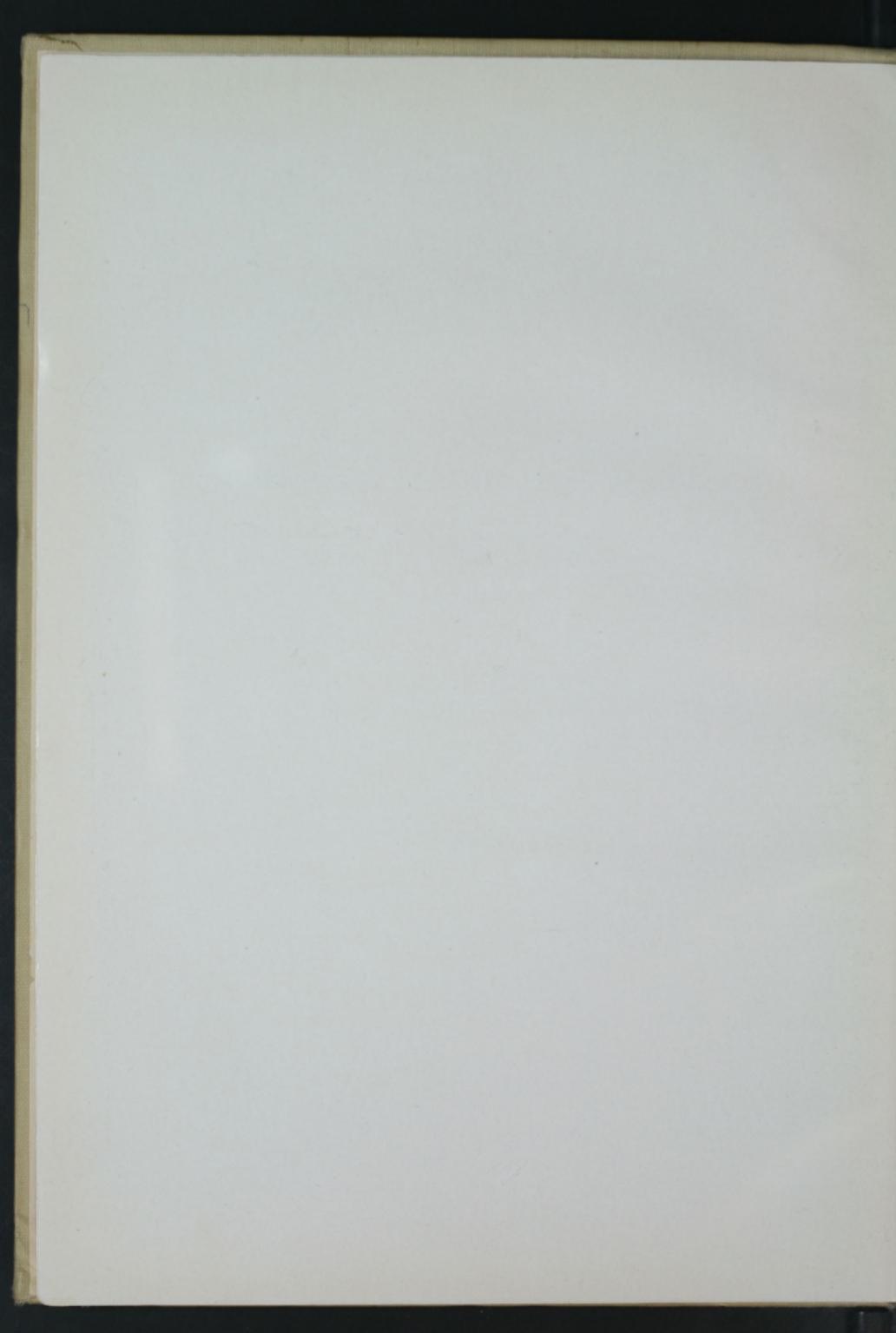
9639.1
OK435
T.L.

OKLAHOMA GAME AND FISH COMMISSION

Glade KirkpatrickChairman
James W. BooneVice Chairman
Jay B. Earp.....Secretary
Carl TicerMember
James W. McMahan.....Member

Jeff F. Kendall.....State Game and Fish Warden

A. D. Aldrich.....Superintendent of Fisheries
Finis Cox.....Superintendent of Game Management
L. G. Duck.....Director,
Division of Wildlife Restoration and Research
Juanita Mahaffey.....Chief Clerk



FOREWORD

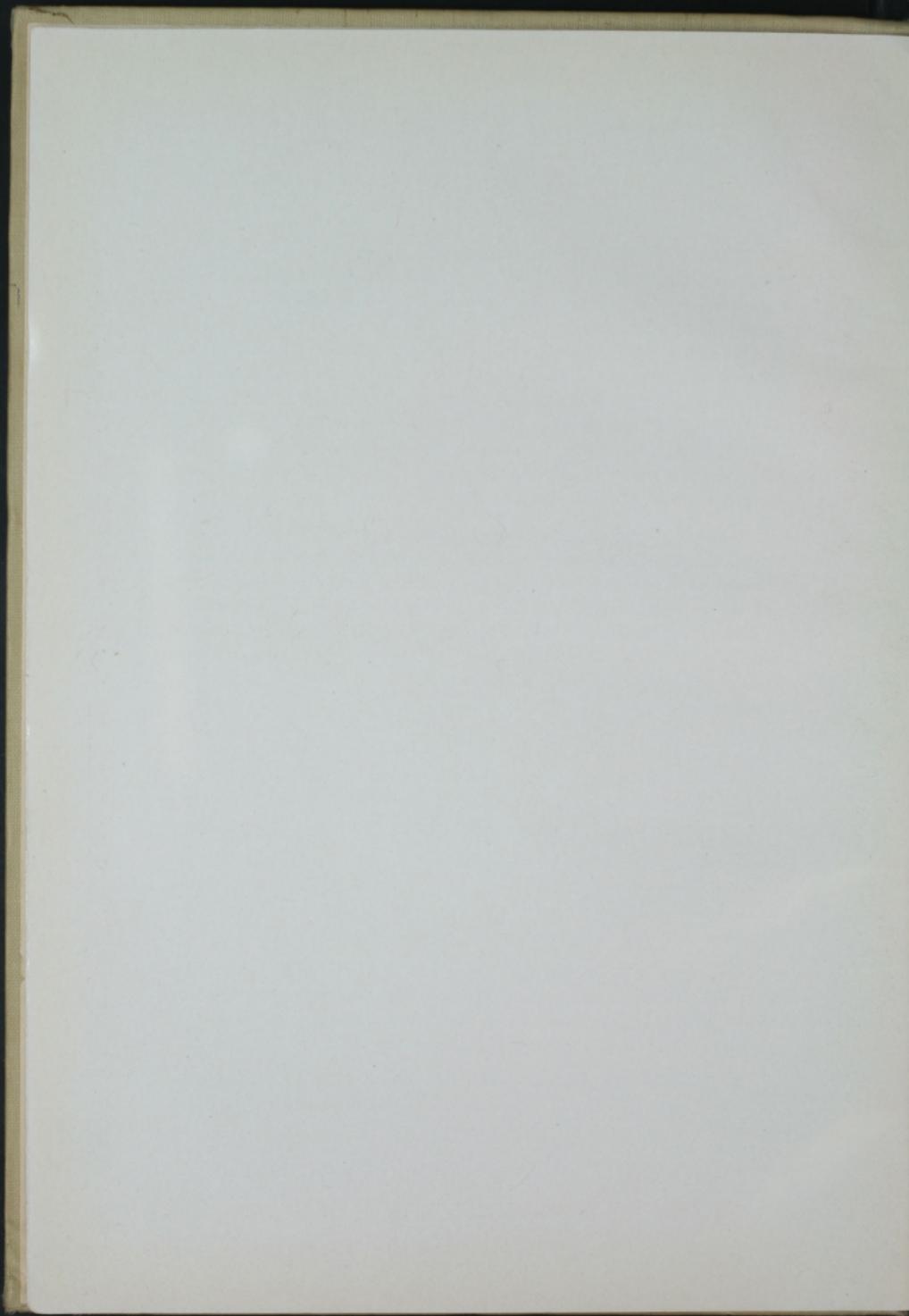
PURPOSE OF THE SURVEY. The purpose of this survey was to make an adequate inventory of the wildlife resources of the State of Oklahoma. It was hoped that through this work the Game and Fish Commission could know exactly what it had and exactly what could be done toward making the best possible use of this resource. Such a project was necessary because information of this nature was not available and no far reaching, long time program of game administration could be initiated without having this information on which to base activities. Based on the project work which extended over a period of four years, the Game and Fish Commission has acquired information enabling it to establish a progressive program of game management, compatible with existing social and economic conditions.

Actually this report has served as a basis upon which the Game and Fish Commission, in organizing its activities, recognizes scientific game management and investigation as an important part of game administration procedure. The Division of Federal Aid has developed into what now is known as the Division of Wildlife Restoration and Research and functions in the main as a fact finding body. That is, its responsibilities are by nature largely research, the results of which are immediately put in effect by the Division of Game Management of the Oklahoma Game and Fish Commission. Whereas recommendations of the type included within this report usually reach print before application, it is the pleasure of the writers to announce that in this case the recommendations, on the whole, have been accepted and initiated prior to the printing of the report upon which they were based.

It was not the specific intention of the project under which the work was done to submit the results of the game survey for public consumption. However, the Game and Fish Commission, believing that much of the accumulated information will be of interest to the sportsmen of the state, as well as others interested in wildlife, has made possible the wide distribution of this work.

As is to be expected, this work is not final and conclusive. It would be to the best interest of all to bring the subject up to date at periodic intervals since it is expected that progress in game procedure, changing economic conditions, and land use practices will alter the wildlife picture as time goes by.

The report as submitted here represents a summary of the numerous technical discussions now on file in the office of the Game and Fish Department where they may be consulted when wished.



ACKNOWLEDGMENT

This survey was conducted by the Oklahoma Game and Fish Commission under the provisions of the Federal Aid to Wildlife Act. Lyle F. Selko was director of the project throughout a portion of the work. Sole responsibility for the interpretation and analysis of the field reports is assumed by L. G. Duck and Jack B. Fletcher, authors of the report. Collection and reporting on field investigations was done by the following staff members:

Laurits Krefting, Jack B. Fletcher and Lawrence Temple, who collected field data for eastern Oklahoma; and O'Reilly Sandoz, L. G. Duck and H. Gordon Hanson, who collected field data for western Oklahoma. Krefting and Fletcher are responsible for the report on Deer and Greater Prairie Chicken, while Sandoz, Duck and Hanson gathered the field data on Lesser Prairie Chicken and Scaled Quail. The Bobwhite Quail report was compiled from field reports from both eastern and western Oklahoma.

The Game Type Map for eastern Oklahoma was largely completed under the crew of Krefting and Fletcher. In western Oklahoma Sandoz and Duck initiated the mapping with some five counties, the remainder being completed by Duck and Hanson.

So many sources of information and aid were used, it is obviously beyond the scope of this type of report to acknowledge each. However, it may be said that game rangers, sportsmen and all associated State and Federal agencies contributed extensively in making the study possible. The writers especially wish to extend thanks to Miss Juanita Mahaffey for the departmental research used in the report as well as aid in editing the final copy for printing, and finally to Mr. Jeff F. Kendall, state game and fish warden and members of the Oklahoma game and fish commission for their aid in getting the report and game cover type map published.

TABLE OF CONTENTS

	Page
Foreword	5
Acknowledgment	7
Chapter I — The General Picture	13
Chapter II — The Game Types of Oklahoma	15
Chapter III — The Bobwhite Quail	46
Chapter IV — The Prairie Grouse	64
Chapter V — The Scaled Quail	78
Chapter VI — The Mourning Dove	81
Chapter VII — Wild Turkey	85
Chapter VIII — Ringnecked Pheasant	89
Chapter IX — American Woodcock	90
Chapter X — Miscellaneous Game Birds	91
Chapter XI — The Whitetail Deer	92
Chapter XII — The Squirrels	104
Chapter XIII — The Rabbits of Oklahoma	110
Chapter XIV — Miscellaneous Mammals	112
Chapter XV — The Furbearers	113
Bibliography	144

LIST OF CHARTS

	Page
Chart I Showing Population Trends and Comparisons on Restocked Areas and Hunted Non-stocked Areas	57
Chart II Bobwhite Trend on Crawford Pasture, Woodward County, Oklahoma.....	59
Chart III Results of Mourning Dove Roadside Count in Western Oklahoma.....	82
Chart IV Table Showing Breakdown of Doves per Mile on Stream Influence Within Major Game Types of Western Oklahoma.....	83
Chart V The Fur Market in Oklahoma.....	114
Chart VI The Opossum in the Oklahoma Fur Trade.....	117
Chart VII The Striped Skunk in the Oklahoma Fur Trade.....	119
Chart VIII The Spotted Skunk (Civet).....	120
Chart IX The Muskrat in the Oklahoma Fur Trade.....	122
Chart X The Raccoon in the Oklahoma Fur Trade.....	126
Chart XI The Coyote in the Oklahoma Fur Trade.....	129
Chart XII The Wolf	130
Chart XIII The Mink in the Oklahoma Fur Trade.....	131
Chart XV The Badger	134
Chart XVI Composition of Oklahoma Fur Industry.....	136

LIST OF MAPS

	Page
Map I Bobwhite	63a
Map II Prairie Chicken	77a
Map III Wild Turkey and Scaled Quail.....	85a
Map IV Pheasant and Woodcock.....	90a
Map V Deer Populations, Range and Densities in Oklahoma.....	102a
Map VI Opossum Pelts Marketed.....	116a
Map VII Striped Skunk Pelts Marketed.....	119a
Map VIII The Little Spotted Skunk (Civet Cat) Pelts Marketed.....	120a
Map IX Muskrat Pelts Marketed.....	122a
Map X Raccoon Pelts Marketed.....	126a
Map XI Combined Coyote and Wolf Pelts Marketed.....	128a
Map XII Mink Pelts Marketed	130a
Map XIII Gray Fox Pelts Marketed.....	132a
Map XIV Badger Pelts Marketed	134a
Map XV Total Pelts Marketed by County	136a

LIST OF TABLES

		Page
Table I	Game Type Classification for Oklahoma	15
Table II	Approximate Area in Square Miles Occupied by Game Types of Oklahoma.....	16
Table III	Bobwhite Populations for Oklahoma—1941	48
Table IV	Showing Tabulation of Population Changes in Northwest Oklahoma	51
Table V	Classification of Bobwhite Refuges	54
Table VI	Comparison of Populations: Refuges and Stocked with Hunted-unstocked.....	56
Table VII	Comparison of Weights of Bobwhite	60
Table VIII	Summary of Greater Prairie Chicken Census Data by Counties.....	65
Table IX	Showing Hand Use Composition of Prairie Chicken Census Plots.....	70
Table X	The Lesser Prairie Chicken Population in Oklahoma.....	71
Table XI	Present and Potential Populations for Prairie Chicken in Oklahoma	77
Table XII	Tabulation of Weights of 149 Scaled Quail	80
Table XIII	Tabulated Results of Roadside Dove Count Western Oklahoma—1940.....	84
Table XIV	Wild Turkey Locations and Estimates	86
Table XV	Woodcock Observations	90
Table XVI	Deer Population in Southeastern Oklahoma.....	94
Table XVII	Deer Kill Record by Counties.....	97
Table XVIII	Age Determination Summary of Oklahoma Deer	97
Table XIX	Time Area Squirrel Counts on Mohawk Park, Tulsa County.....	108
Table XX	Leaf Nest Counts on Mohawk Park, Tulsa County.....	108
Table XXI	Census Figures for Cottontail Rabbits, Fall of 1940.....	110
Table XXII	Census Figures for Jackrabbits in Western Oklahoma, 1940	111
Table XXIII	Fur Trapper and Dealer License Sales.....	115
Table XXIV	Showing Composition of the Oklahoma Fur Industry.....	136
Table XXV	Tabulated Fur Records for Oklahoma, 1938-39, 1943-44.....	138
Table XXVI	Summary of Fur Records	139
Table XXVII	Showing Opinions Tabulated on Fur Season.....	140
Table XXVIII	Number Dealers in Each District Favoring Closed Seasons.....	140
Table XXIX	Income Groups for Annual Fur Sales in Woodward County.....	142
Table XXX	Average Income Per Trapper on Game Types of Woodward County.....	142
Table XXXI	Percent of Pelts of Each Species Marketed in Woodward County.....	142
Table XXXII	Number of Trappers and Acreage of Game Types in Woodward County.....	143
Table XXXIII	Comparison of Fur Sales and Values of Game Cover in Woodward County.....	143

LIST OF ILLUSTRATIONS

		Page
Plate I	Post Oak-Blackjack Type in South Central Oklahoma Showing Absence of Suitable Undercover for Game Caused by Overgrazing	18
Plate II	Post Oak-Blackjack Type in South Central Oklahoma Soil Fertility Reduced by Erosion and Unwise Crupping, Resulting in Poor Game Habitat	19
Plate III	Post Oak-Blackjack Type in Oklahoma Showing Excellent Development of Game Cover on Right-of-Way	19
Plate IV	Post Oak-Blackjack Type in Northeast Oklahoma. Note Excellent Field Margin Conditions for Game	20
Plate V	Post Oak-Blackjack Type. Note Excellent Understory Preserved Through Moderate Grazing and Fire Control	20
Plate VI	Selective Clearing, Brush Piling and Moderate Crupping is Beneficial to Grass as Well as Game (Post Oak-Blackjack)	21
Plate VII	Typical View of Oak-Hickory Game Type in Northeast Oklahoma	22
Plate VIII	Showing Excellent Forest Margin Condition in Oak-Hickory Type in Northeast Oklahoma	23
Plate IX	Typical Bottomland Condition Within Prairie Types. Habitat Subject to Seasonal Flooding	24
Plate X	Bottomland Type in Cimarron County	24
Plate XI	Cultivated Bottoms of Washita Valley in South Central Oklahoma	25
Plate XII	Excellent Field Margin Conditions for Bobwhite in Johnston County	25
Plate XIII	Typical Dense Bottomland Habitat of Southeastern Oklahoma	26
Plate XIV	Typical View of Uncut Oak-Pine Type in McCurtain County	27
Plate XV	Showing Bottomland Surrounded by Oak-Pine Type in Southeast Oklahoma	28
Plate XVI	Typical Tall Grass Type Condition in Grant County. Note Total Absence of Game Cover Due to Arability and Fertility of Soil	29
Plate XVII	Roadside Burning Damages Bobwhite Cover on the Tallgrass Type	30
Plate XVIII	Mixed Grass Mesquite Plains	31
Plate XIX	Showing the Well Wooded Stream Courses in the Mixed Grass-eroded Plains Type. Washita County	32
Plate XX	Showing the Dissected Plain of the Mixed Grass-eroded Plains Type, Woodward County	32
Plate XXI	"Blowouts" Begin Stabilized by Invading Vegetation After Denudation by Overgrazing. Results of Fencing in Quail Management Experiment	33
Plate XXII	Typical Vegetation Composition of the Stabilized-Dune Type. Note Excellent Variety of Species	34
Plate XXIII	One of the Few Excellent Natural Lakes Within Stabilized Dune Type	34
Plate XXIV	Erosion on Shinnery Type Soils Produced by Removal of Vegetation Protection Through Heavy Grazing, Drouth and Cultivation	35
Plate XXV	Old Field "Blowout" Caused by Wind Erosion on Cultivated Sandy Soils	36
Plate XXVI	Typical View of Shinnery-Grassland Game Type. Ellis County. Note Circular Clumps of Shinnery Oaks	37
Plate XXVII	Showing Excellent Recovery of Pasture From Effects of Drouth and Overgrazing. The Result of Wise Pasture Management	37
Plate XXVIII	Typical View of Sand sage Type in Southeast Oklahoma	38
Plate XXIX	These Hunters Got Their Limit of Bobwhite. Showing Moderately Grazed, Unburned Sand sage Pastureland in Harper County	39
Plate XXX	Abandoned Farmstead on Shortgrass High Plains Game Type. Serves as Headquarters for a Large Covey of Scaled Quail	40
Plate XXXI	Russian Thistle Collected Against Barbed Wire. Scaled Quail Utilize These for Fall Cover	41
Plate XXXII	Showing Absence of Winter Game Cover Along Highway in Shortgrass-High Plains Game Type, Texas County	41
Plate XXXIII	The Beginning of Recovery of Shortgrass-High Plains Type, Denuded by Wind Erosion. Note Abundance of Young Sprouts of Russian Thistle	42
Plate XXXIV	Aerial View of the Broad Level Valleys and Picturesque "Mesas" of the Pinon-Juniper Mesa Game Type in Northwest Cimarron County	43
Plate XXXV	"Mesa" Influence Serves as Important Place in Scaled Quail Environment in Northwest Cimarron County	43

	Page
Plate XXXVI	Typical View of Pinon-Juniper Mesa Game Type West of Kenton, Oklahoma..... 44
Plate XXXVII	The Valley of the Cimarron River From Atop "Black Mesa" in Cimarron County, Oklahoma.... 44
Plate XXXVIII	Quail Census Crew--National Youth Administration Boys..... 47
Plate XXXIX	Releasing Hatchery Reared Bobwhites for Experimental Purposes..... 58
Plate XL	Fencing a Sandhill Blowout Allowed Recovery by Vegetation and Added Another "Covey" to this Pasture 62
Plate XLI	Showing Recovery of Poor Habitat by Fencing Out a Small Area From Trampling and Grazing by Cattle..... 62
Plate XLII	Prairie Fires Cause Much Damage to Prairie Chicken Nests..... 66
Plate XLIII	Lesser Prairie Chicken Nest, Ellis County..... 74
Plate XLIV	Field Workers Building Prairie Chicken Net Used in Transplanting of Stock..... 75
Plate XLV	Setting Up Net for Capture of Prairie Chicken..... 75
Plate XLVI	Locating Prairie Chicken Broods for Netting..... 76
Plate XLVII	Netting Scaled Quail in the Wild to be Used for Hatchery Brood Stock..... 80
Plate XLVIII	Taking Weights and Beam Diameter Measurement of Buck Killed in Open Season, McCurain County 95
Plate XLIX	View of "Rabbit Trap" Type of Trigger on Deer Traps..... 100
Plate L	Carrying Crate for Transporting Deer From Trapping Area to Release Area..... 100
Plate LI	Showing Front End of Baited Trap..... 101
Plate LII	The Pisgah National Forest Style Trap Used in Re-Stocking Work..... 101
Plate LIII	Releasing Adult Deer on Project Area, Northeast Oklahoma..... 102
Plate LIV	One Style of Trap Used in Capture of Adult Stock for Transplanting..... 102
Plate LV	Feeding Fawns on Bottle. These Fawns Are Used to Restock Oklahoma's Deer Range..... 103
Plate LVI	Young Gray Squirrels in a Leaf Nest in July..... 109
Plate LVII	Artificial Den. A Part of the Research in Raccoon Restoration..... 121
Plate LVIII	'Coon Hunter Sportsman Assisting in the Raccoon Restocking Work..... 123
Plate LIX	Tagging Trapped Raccoon With Aluminum Ear Tag so a Check-up Can Be Made After Release.. 124
Plate LX	Technicians Transferring Live Raccoons from Tagging Net to Delivery Crate..... 124
Plate LXI	Raccoon Released on Selected Refuge--A Part of the Restoration Program..... 125
Plate LXII	Removing Raccoon From Trap..... 127
Plate LXIII	Raccoon Trapped for Restocking Purposes. Sportsmen Aiding in the Trapping..... 127
Plate LXIV	The Stomach Contents of the Coyote Were Analyzed and Found to Consist of Rabbit..... 128
Plate LXV	Showing Game Ranger With Two Bobcats Trapped in Part of Study on Food Habits and Ecology of this Species 132
Plate LXVI	Beaver Cuttings on the North Canadian River, Woodward County..... 134
Plate LXVII	Beaver Damage to Large Tree, Major County..... 136

CHAPTER I.

THE GENERAL PICTURE

The general outlook for the game problems of Oklahoma may well be one of justified optimism. Few states hold such an undeveloped potentiality for increased population of game and furbearing species. Oklahoma is a new state and much can be done. Fortunately many species such as bobwhite quail, mourning dove, cottontail rabbit and certain furbearers have been able not only to maintain themselves in spite of human use of their habitats, but in many cases have actually found this disturbance more to their liking than the original condition. Yet, as the demand for game increases, as it has over the years, Oklahoma must now take steps to provide the increased hunting public this recreation while the essential requirements of a game country are still with us.

It may be said that in most instances techniques are fairly well known for increasing and maintaining game and furbearer populations. Insofar as Oklahoma is concerned, in most instances, these techniques have to do with habitat improvement. In a few cases stronger legal protection from both illegal and present legal shooting is required. However, in the general picture, habitat improvement will solve the major problems.

ADMINISTRATION

Generally it may be said that in the analysis of the shortcomings of game administration in Oklahoma, sportsmen have failed to place emphasis on the basic factors responsible for the whole structure of accomplishment, or the lack of it. Often it is the miscellaneous technique employed which bears the brunt of public criticism. For example: Closed seasons, bag limits, method of taking, and other secondary problems receive the most attention while the very factors responsible for such inadequacy are overlooked.

Closer examination of the matter will reveal that these secondary problems are a result of a more basic fault, and, until this is fully realized, there will continue to be confusion and lack of coordinate effort toward solving the problems of game administration in Oklahoma.

In the opinion of experienced administrators, discretionary powers of the Commission in these secondary problems or purely

regulatory matters such as seasons, bag limits, method of taking and size limits are essential. Legislative action on these matters is entirely too cumbersome and slow in functioning for intelligent wildlife management.

It has been found in most states that a sound game policy depends almost entirely on the permanence of the organization charged with the responsibility of carrying it out. This is so because such a program is necessarily a long time one in which results are accumulative. It should be apparent to sportsmen of Oklahoma by this time that satisfactory results cannot be had during the length of time a single administration remains in the state offices of Oklahoma, and that the regular change in game administration and personnel which accompanies each political change merely makes for a repeating of the mistakes of the past administration. There can be no continuity of effort or record in such a system. Thus the fault lies not with a particular game administration, but with the system which allows the destruction of each administration's organization, even before it has had time to function properly.

An examination of the systems of organization under which the agencies charged with administering the affairs of game and fish of the different states of the United States operate, reveals certain fundamental considerations which figure in efficient and progressive administration. Throughout, most of these systems recognize that certain laws or regulations are necessary which guarantee (1) an efficient administrative body with a continuity of policy, (2) well trained personnel with some permanence of employment, (3) education both of Commission personnel and the public, (4) research into game problems, and (5) a long time planning program. Obviously some of these factors more or less guarantee the existence of others, but their individual importance warrants their separate statement.

THE GAME AND FISH COMMISSIONERS

Obviously the factor ranking first in importance is that concerned with the administrative body. It is on intelligence and permanence of administration that the proper functioning of field, research, and operational activities depend. It appears self evident from examination of such functions that the proper selection and proper identification

of authority of the Game and Fish Commissioners forms the foundation for efficient operation of the rest of the organization. Briefly the record shows that the function of the Commissioners individually or as a body should be no more than that of forming policies. In many instances the law clearly defines the responsibilities of the Commissioners as confined to a group opinion on matters of policy alone. It is generally recognized that Commissioners should be well known game and fish conservationists whose background demonstrates clearly their sincere interest in the propagation and protection of Oklahoma's wildlife resources. They should be selected on a basis of staggered tenure of office, numbering between five and eight men, and each serving in office from five to eight years.

SELECTION AND COMPENSATION OF STATE GAME AND FISH WARDEN

The State Game and Fish Warden should be the full time executive officer of the Commission. He should have the general supervision and control of all activities, functions, and employees of the Game and Fish Commission, under the supervision and direction of the Commissioner body, and should enforce all the provisions of the laws of the State relating to wild animals, birds and fish, and should exercise all necessary powers incident thereto, not specifically conferred on the Commissioner body. It is vitally important that the authority to select this executive and set his salary be left with the Commission, not with the Governor and the legislature, and the same applies to the retention and selection of all other employees. To do otherwise can completely nullify an otherwise excellent administration.

SELECTION OF PERSONNEL

With the exception of stenographic and general office employees the legislature should provide a means of assuring the Game and Fish personnel of permanence of employment. Thousands of dollars of the sportsmen's money in Oklahoma has been spent in training division heads, technical men and rangers in the performance of their

work, only to have the expenditure lost with the change of an administration. The ability to discharge the duties and obligations of wildlife enforcement and conservation is not inherent but is the result of training and experience. It is an expensive procedure to properly train these employees and the State should be assured the benefit of their continued service.

Before being placed in wildlife and conservation work, each applicant should pass a rigid qualifying examination and attend a school maintained by the Commission, from which the applicant must graduate before entering permanent service. Only thus can continuity of service and freedom from arbitrary changes be obtained. This procedure serves two purposes. It discourages mere job seekers and guarantees an operational force in which each member has qualified himself for the work.

Many states now require that the men, either at the beginning of their service or at regular periods during their service, attend an educational course for the purpose of obtaining information on legal procedure, life histories of animals, identification of animals and plants, game and fish management, relations with the school and press, and like material.

SUMMARY

In summary it may be said that in making this report available to the general public, the Game and Fish Commission fully recognizes the importance of a full understanding of the problems discussed within this portion of the survey study. Generally such shortcomings as are discussed here are more readily apparent to members of the Game and Fish Commission than they are to interested sportsmen, and so in pretending them, it is sincerely hoped that the criticisms be seen as they are—in the nature of corrective suggestions based on close observation and careful study of conditions within the State.

—Glade Kirkpatrick, Chairman
Oklahoma Game and Fish Commission

CHAPTER II.

THE GAME TYPES OF OKLAHOMA

INTRODUCTION

Due to the wide diversification in game habitat in Oklahoma, an understanding of the character and extent of these conditions today is essential to those who expect to successfully manipulate game populations to the best interest of the people. Oklahoma is so situated within the nation as to enclose that portion of the continent where the eastern forests merge with the prairies and plains of the west. This is reflected in the presence of game species typical of both the eastern forests and the western grasslands within the confines of the state.

A review of the existing studies of the biological and physical land features showed that any one study within itself was not

adaptable to practical game management problems. A map of more detail, as well as one with more varied emphasis was needed. So included within the survey outlines were facilities for mapping the game habitat of Oklahoma.

The map presented with this book is a result of actual field mapping correlated with prior studies concerning vegetation, geology, soils, climate, and land use in relation to game populations, and is, we believe, in sufficient detail for wide application in future game studies.

Game habitat conditions in this work have been classified under three general headings. A total of twelve types have been defined of which five are forested, four are shrub grassland, and three are agricultural grassland types.

TABLE I

GAME TYPE CLASSIFICATION FOR OKLAHOMA

FORESTED TYPES:

Post Oak-Blackjack	17,628.75	
Bottomland	3,427.20	
Oak Pine	4,992.00	
Oak Hickory	3,713.00	
Loblolly Pine-Hardwood	120.00	
	<hr/>	
	29,880.95	Sq. Mi.

SHRUB GRASSLAND TYPES:

Pinon Juniper Mesa	355.00	
Sand Sage Grassland	2,600.60	
Shinnery Grassland	1,173.00	
Stabilized Dune	368.75	
	<hr/>	
	4,497.35	Sq. Mi.

AGRICULTURAL GRASSLAND TYPES:

Tall Grass Prairie	20,484.00	
Mixed Grass-Eroded Plains	10,111.50	
Short Grass-High Plains	5,294.20	
	<hr/>	
	35,889.70	Sq. Mi.

It will be noticed throughout this report that particular topics are dealt with at some length under certain types and but briefly mentioned in others. Generally this results from the workers not being able to obtain information of equal detail for all type conditions. Rather than omit a discussion of importance simply because it was not available throughout, we have included such information here without regard to strict outline in hopes that it may be available at a later date.

The game type map presented with this report is a generalized one, being scaled down from field copies which are one-half inch to the mile and in considerable detail.

USE OF THE GAME TYPE MAP

There is much difference of opinion among professional workers in game management as to the value of a game type map and, to date, very few states have completed such a work. Generally, however, it must be conceded that a statewide picture of game environment, is indispensable to those whose responsibility it is to plan and administer the state program. A good many states have

substituted in the materials found necessary to other land use agencies such as the forestry and grazing service, and refer to these works when necessary. In Oklahoma, however, the game and fish department has had opportunity to use the present game type map in its work over a period of a year and has found it well worth more than the effort expended in obtaining the necessary information. Such data as land use figures, human populations, and the like may of course be refined as time goes on, but the chief value of the work has been in acquainting the department in general with the statewide picture. It makes possible the calculation of total habitat type necessary to any particular game species in a relatively short time.

A quite clear picture can be obtained concerning the present and future of most any species if the map and associated information are carefully considered. The present workers have found this map invaluable in their work with restoration and management in Oklahoma and hope that the sportsmen will take the necessary time to become acquainted with these types of game environment in Oklahoma.

TABLE II.
APPROXIMATE AREA IN SQUARE MILES OCCUPIED BY THE GAME TYPES OF OKLAHOMA

COUNTY	Tall Grass	Mixed Grass & Hard Plains	Short Grass High Plains	Sand Sage & Grass Land	Stabilized Dune	Bottomland Timber	Postoak Blackjack	Oak Pine	Oak Hickory	Shiny Grass Land	Pinon-Juniper Mesas	Mesquite Grassland*	Loblolly Pine Forest	Total Square Miles
Adair						5	11	25	54.3					584
Alfalfa	530	110		142		71	14							867
Atoka	55					15	435	275	217					997
Beaver		3	1475	267		68*								1813
Beckham	8	601		20		49				228		150		906
Blaine	528	84.5		37.25	15.25	49	234							948
Bryan	450					60	408		10					928
Caddo	643	67				50	536							1296
Canadian	687.5	11.5		8.5	3	74	106.5							891
Carter	217					77	537							831
Cherokee						23	55	115	508					701
Choctaw	62					50	439	90	68					709
Cimarron			1127	282		79					355			1843
Cleveland	153					48	356							557
Coal	108					8	406							522
Comanche	391	463				8	224					12		1096
Cotton	54	552.5		18.5		30	1					30.5		656

COUNTY	Tall Grass	Mixed Grass and Plains	Short Grass Rich Plains	Semi-Stepe Grass Land	Stabilized Dune	Bottomland Timber	Postoak Blackjack	Oak Pine	Oak Hickory	Shiny Grass Land	Pinon-Juniper Mesq	Montane Grassland*	Loblolly Pine Forest	Total Square Miles
Craig	681					3	65		21					770
Creek	25					15	922							962
Custer	290	690				21	7							1008
Delaware	25					7	41	8	713					794
Dewey	246	422		115	8	35	178			14				1018
Ellis		269	409	133		54				341				1206
Garfield	1030						31							1061
Garvin	260					122.5	439.5							822
Grady	637.5					41.5	448							1127
Grant	882			116		10								1008
Greer	1	467		83		42	9			42		297		644
Harmon	37.5	401.5		4.5		19				72.5		155.5		538
Harper		228	515	222	3	35								1033
Haskell	110					40	255	100	110					615
Hughes	182					6	596		6					790
Jackson	90	504		90.25		68	5.25			10.5		198		828
Jefferson	609.5	14.5		12		36	95					9		767
Johnston	197					42	419							658
Kay	873			5		39	17							934
Kingfisher	648	8			35.5	23	197.5							912
Kiowa	75	928		5		14	36			1		33		1059
Latimer	15					2	14	629	60					720
Leflore	70					55	340	1119	30					1614
Lincoln	91					9	860							960
Logan	390.5				10	9.5	398							748
Love	90			1		54	351							496
McClain	334					57	171							562
McCurtain						310	23	1247	197				120	1897
McIntosh	180					88	170		270					708
Major	231	295		39	55	30	316							966
Marshall	204					78	142							424
Mayes	343					35	78		220					676
Murray	278					34	112							424
Muskogee	589					33	97		95					814
Noble	701					12	33							746
Nowata	501					50	35							586
Okfuskee	133					20	466		4					623
Oklahoma	267.5					52.5	400							720
Okmulgee	310					25	346		3					684
Osage	997					35	1245							2277
Ottawa	286					36			155					477
Pawnee	369					15	200							584

COUNTY	Tall Grass	Mixed Grass Eroded Plains	Short Grass Plains	Sand Sage Grass Land	Stabilized Dune	Bottomland Timber	Postoak Blackjack	Oak Pine	Oak Hickory	Shinnery Grass Land	Pine-Jumper	Mesquite Grassland* Loblolly Pine forest	Total Square Miles	
Payne	352					36	290						678	
Pittsburg	167					20	1076	94	13				1370	
Pontotoc	235					107	375						717	
Pottawatomic	54					20	719						793	
Pushmataha						8	7	1290	125				1430	
Roger Mills		669		49		59				373			1150	
Rogers	413					60	165						638	
Seminole	90					23	520						633	
Sequoyah						70	235		328				633	
Stephens	316						581						897	
Texas			1690.2	301.6		73.2							2065	
Tillman	265	535		40		60						17	917	
Tulsa	355					90	140						585	
Wagoner	319					135	100		11				565	
Washington	320					40	65						425	
Washita	295	678.5				21	6.5			5	1		1006	
Woods	116	668		258	164	49							1255	
Woodward	84	475.5	48	351	75	79	34.5			86			1233	
TOTALS	20,487	9,208.5	5,294.2	2,600.6	368.75	3,427.2	17,628.75	4,992	3,713	1,173	355	903*	120	69,368

* Subdivision of the Mixed Grass Eroded Plains.



Plate I—Post Oak-Blackjack Type in south central Oklahoma, showing absence of suitable undercover for game. Caused by overgrazing.



Plate II—Post Oak Blackjack Type in south central Oklahoma. Soil fertility reduced by erosion and unwise cropping, resulting in poor game habitat.

POST OAK BLACKJACK—GAME TYPE DEFINITION

The Post Oak Blackjack game type represents the forest-grassland ecotone and contains dominants from both the deciduous formation and the grassland formation. The overstory is largely composed of Post Oak (*Quercus stellata*), Blackjack Oak (*Q. marilandica*), and Black Hickory (*Carya Buckleyi*), with the percent of Blackjack Oak increasing in the composition as one moves west

through the type. The understory is made up of little bluestem (*Andropogon scoparius*), big bluestem (*A. furcatus*), and other species depending upon the site.

Its best correlation with other works is with the Oak Savana of the Soil Conservation Service. There are approximately 17,600 square miles of this condition which includes generally the east central portion of the state with fingers reaching as far west as Cleo Springs in Major County, Curtis in Wood-



Plate III—Post Oak Blackjack Type in northern Oklahoma showing excellent development of game cover on right of way.



Plate IV—Post Oak-Blackjack Type in northwest Oklahoma. Note excellent field margin conditions for game.

ward County, Webb in Dewey County, and Western Comanche County. The northeastern portion lying on the north side of the South Canadian, North Canadian and Cimarron rivers differs importantly from the rest of the type. This section is supported by deep sandy Quaternary soils.

CLIMATIC CHARACTERISTICS

The Post Oak Blackjack game type lies within the climatic province characterized as subhumid, mesothermal and adequate

moisture for all seasons. Average annual precipitation varies from 25 inches on the west to 42 inches on the east with the bulk of the type having between 32-40 inches.

This type usually lies above the flooded lands, and game populations are not influenced by rainy seasons as on adjoining grassland types. Drouth periods here reflect in serious shortage of food and cover plants. However, this is usually furthered by continued heavy grazing.



Plate V—Post Oak-Blackjack Type. Note excellent understory preserved through moderate grazing and fire control.

PHYSICAL CHARACTERISTICS

The topography of this type is characteristically rolling to rough, with sufficient local variation to make for excellent small game conditions.

Generally, this type is supported by coarse textured, relatively poor soils developed from residual sandstones and weathered shales. The soils are leached and acid in reaction. The northwest fingers of the type are supported on wind deposited sand for the most part, and is slightly dune-like in relief.

LAND USE CHARACTERISTICS

The Post Oak-Blackjack game type, as found through the cross timbers agricultural region of the state, presents some of the most serious problems of sheet and gully erosion in the country, and productivity of the land as a game producer, as well as a human producer, has been seriously reduced. Farm tenancy is high, averaging around 65-70% for the entire type. Better than 50 percent of these tenant families remain on the same farm for only one year or less. The average farm size is around 80 acres and the principal crop is cotton. Grain sorghums, berries, peanuts, and orchards are becoming more important in certain sections. Approximately 75% of the type is still in woodland.

WILDLIFE CHARACTERISTICS

This type offers more in the way of farm game management possibilities than the other types. Improved farming methods result in better small game habitat. The prin-

cipal species are the bobwhite, fox squirrel, cottontail rabbit. White-tail deer are found scattered throughout the type. Furbearers although locally low, are fully represented here. For the bulk of the type, marginal conditions such as railroad right-of-ways, county road margins, field edges and prairie woods margins account for the main part of the small game habitat. In the center of wooded areas quail are abundant only when soil disturbances have brought about a variation in the vegetation.

For the most part, game populations, particularly bobwhite quail and cottontail, are not in need of serious attention in the northwestern portion of the type. The remainder, however, could be made to support a very much higher quail population than it does at present, largely because burning and heavy grazing result in more serious destruction of game habitat than in the northwest. The soils here are either naturally poor or poor through depletion, and fenced areas often do not show an immediate development as they should. Fertilization is often necessary to restore the vegetation.

Potentially, the post oak-blackjack condition is a good game and fur producer, and because of its large size it warrants serious attention. Practically all large human centers of population east of El Reno are either within or near the type and it probably supports a heavier hunting pressure than any other type.

It must be emphasized that the game increase of this type is an agricultural problem



Plate VI—Selective clearing, brush piles and moderate grazing is beneficial to grass as well as game. (post-oak blackjack)

and must be attacked through cooperation with farm agencies and local sportsmen, garden clubs, etc.

THE OAK-HICKORY FOREST TYPE DEFINITION

The Oak-hickory Forest Game Type is located largely in the northeastern portion of the state and includes the highlands referred to by most writers as the Ozark Mountains. It is designated as the Ozark Biotic District by Blair and Hubbel (1938), and as Oak-hickory Forest Type by the U. S. Soil Conservation Service workers. The present condition has been mapped to include an area of approximately 100 miles by 40 miles



Plate VII—Typical view of Oak-Hickory game type in northeast Oklahoma.

bounded on the west by the Grand River, and including the counties of Adair, Cherokee and parts of Delaware, Sequoyah, Muskogee, Craig, Mayes, Wagoner and Ottawa.

The type is characterized by a vegetation comprised of such species as Blackjack Oak (*Quercus marilandica*), Post Oak (*Q. stellata*), Red Oak (*Q. rubra*), Pin Oak (*Q. palustris*), Black Oak (*Q. velutina*), White Oak (*Q. alba*), Black Hickory (*Carya Buckleyi*), Scaly Bark Hickory (*Carya laciniosa*), Pignut Hickory (*C. glabra*), Winged Elm (*Ulmus alata*). The ground cover is composed of a mixture of huckleberry (*Vaccinium vacillans*), Coral Berry (*Symphoricarpos orbiculatus*), sassafras (*Sassafras sassafras*), Big Bluestem (*Andropogon furcatus*), spice bush (*Benzoin aestivale*), Bladdernut (*Staphylea trifolia*), hazel-

nut (*Corylus sp.*), May apple (*Pedophyllum peltatum*), Bloodroot (*Sanguinaria canadensis*), and grape (*Vitis aestivalis*).

There are approximately 3,713 square miles of this game condition in Oklahoma.

CLIMATIC CHARACTERISTICS

The Oak-hickory Forest Game Type is located in the northern portion of the climatic province characterized as humid, mesothermal and adequate moisture at all seasons. In this area there are from 190 to 200 days in the growing season. The average annual precipitation is 38 to 44 inches.

PHYSICAL CHARACTERISTICS

The topography of the Oak-hickory Forest Game Type is characterized by a mountainous relief. The maximum elevation is found in Adair county for the type, where some mountains reach around 1500 feet as compared to an elevation of around 600 feet for the larger valleys. The wide distribution of tall limestone bluffs influence the habitat to a considerable extent here.

The area is drained by the Grand and Illinois rivers and their tributaries. These streams are characteristically clear and cold. The soils of the oak-hickory game type are, as a whole, fine textured, light colored calcareous loams where woodland is the natural climax.

LAND USE CHARACTERISTICS

Because of its rugged topography only 30 percent of this type has been cleared for agricultural purposes, and around 70 percent still stands as woodland. Farms are relatively small in size, averaging around 80 acres and valued at an average of \$3,000.00. The principal crops are corn, cotton, wheat, oats and hay. However, within the last ten to fifteen years there has been a noticeable increase in the fruits, vegetables and berries. These latter are now the important cash crops of the region. Most farmers keep a small herd of cattle which they pasture on the open range.

The rural population is around fifteen to twenty-five people per square mile and pas-

ducer of those species desiring more undisturbed habitat, such as deer, fox and gray squirrel. It is estimated that this condition could support around 50,000 deer alone. Wild turkey and rare furbearers may be increased throughout the type. The type, as a whole, offers excellent opportunities for the restoration and increase of all game species existing, as it is in larger areas of forests and small field agriculture.

BOTTOMLAND TIMBER TYPE

The bottomland type includes the first bottom and stream course of all the regular drainage of the state. Due to its statewide consideration there is much variation in the plant composition. In the panhandle and



Plate VIII—Showing excellent forest margin condition in Oak-Hickory Type in northeast Oklahoma.

ture use is relatively heavy. However, because of the diversified crop production and small fields, the woody nature of the type results in satisfactory small game populations in the main.

Farm tenancy in this type exceeds fifty percent. Recent trends, however, seem to indicate somewhat more stability in farm tenure.

WILDLIFE CHARACTERISTICS

The field and timber margins here are the principal producers of the small game species such as bobwhite and cottontail rabbit, and populations run relatively high. The more rugged mountainous country is the pro-

ducer of those species desiring more undisturbed habitat, such as deer, fox and gray squirrel. It is estimated that this condition could support around 50,000 deer alone. Wild turkey and rare furbearers may be increased throughout the type. The type, as a whole, offers excellent opportunities for the restoration and increase of all game species existing, as it is in larger areas of forests and small field agriculture.

western counties much of the bottom acreage is devoid of larger permanent vegetation. In places buffalo grass, blue gramma, Johnson grass and river grass form the dominant plant cover. Scattered growths of cottonwoods are common with a few willows and hackberry. Elms enter into the picture more so throughout the central west. Typical stream growth in central Oklahoma within the Tall Grass Prairie Game Type consist of American elm, chinquapin oak, post oak, blackjack oak, hackberry, chittum wood, cottonwood, chickasaw plum, fragrant sumac, smooth sumac, and rough leafed dogwood. Black oaks, pecan, sycamore, bitternut and walnut are more common southward and eastward.



Plate IX—Typical bottomland condition within prairie types. Habitat subject to seasonal flooding.

Because of differences in rainfall and other factors, both the luxuriance of growth and the number of plant species increase from west to east along the principal east-west streams. More mesic conditions are present in extreme eastern Oklahoma due to the increase in rainfall of 40 inches or more, the low altitude of about 400 feet and the comparatively high humidity. Under these favorable conditions the vegetation shows an increased growth rate and increased number of herb, vine, shrub and trees. In

the southeast corner of the state along Little River, Mountain Fork River and their tributaries, bald cypress (*Taxodium distichum*), sweet gum (*Liquidambar Styraciflua*), sour gum (*Nyssa sylvatica*) as well as white oak, willow oak and water oak, wards willow, buttonbush, alder, mulberry and American holly are the principal tree growths, while in the northeastern section of the state where there is about the same amount of rainfall, the sweet gum, sour gum, willows, American elm, sycamore, hickories, hackberry



Plate X—Bottomland type in Cimarron county.



Plate XI—Cultivated bottoms of Washita valley in south central Oklahoma.

white oak, water oak, willow oak and red oaks are more common.

There is about 3,400 square miles of bottomland type in Oklahoma. Due to the long narrow strips and irregular boundaries of this type an accurate measurement was almost impossible. Some of this type has been set up in every county of the state and on all the major streams.

The surface of this type varies from the flat bottomlands to the steep canyon-like

valleys. The type differs from the other timbered types of the state in that most of the bottom soils are extremely fertile and deep, being alluvial in origin. In some areas saline deposits are present, particularly associated with the Cimarron, Salt Fork of the Arkansas and Salt Fork of Red Rivers.

Climatic characteristics cannot be treated separately for this type since it is found within every type discussed already. Small game populations of the type suffer much



Plate XII—Excellent field margin condition for bobwhite in Johnston county.

from the seasonal floods in the western part of the state where the only available cover is found along the streams. However, this is not the case over a large part of the state where good cover conditions adjoin the bottomland type.

Cultivation of this type increases from west to east through the entire state. In Texas county only 8 percent of the type is cultivated; in Woodward county 15 percent of the type is cultivated; in Pontotoc county 61 percent of the type is cultivated; and in the extreme eastern section of the state it probably runs as high as 75 percent of all available land. Farming is the principal industry of the type and grain sorghums, wheat, oats, vegetables, alfalfa, corn, cotton and native meadows form the bulk of the

This bottomland type offers some of the better game habitat condition in Oklahoma and is capable of supporting many different species. The more common game species are as follows: Bobwhite quail, squirrel (both gray and fox), cottontail, pheasants and such furbearers as raccoon, opossum, skunk, mink, muskrat, beaver. The bobwhite quail, squirrel and the furbearers — raccoon, mink, muskrat, and beaver—are the major species that restoration projects should be concerned with in this type.

THE OAK PINE FOREST GAME TYPE

DEFINITION

The Oak Pine Forest Type occupies the rugged Ouachita Mountain region in south-



Plate XIII—Typical dense bottomland habitat of southeastern Oklahoma.

crops. Farm tenancy is high over the major portion of the region, running as high as 70 percent in the Arkansas and Red River valleys. In the larger bottoms approximately 30 percent of the rural population is negro. The average size of the farms runs about 110 acres, valued on an average at \$4,000.00. Generally game populations are high throughout the type where habitat conditions are good. In many of the better agricultural bottoms along the Arkansas, Red and Washita rivers, game populations are extremely low due to a deficiency of year round cover. This land is cultivated so intensively that very little area is allowed to grow up into the desired weedy and brushy cover.

eastern Oklahoma. Throughout most of the type the shortleaf pine (*Pinus echinata*) is found in a mixture of various oaks and hickories and, in some areas, rather extensive pure stands of the pine are found. Included within the discussion here are about 120 square miles of the Loblolly Pine-Hardwood Game Type in southeastern McCurtain county. Generally this type, as shown by present definition, corresponds with the southern portion of the Oak-hickory Association of Bruner (1931) and the Ouachita Biotic District of Blair and Hubbel (1938). However, it more closely approaches that designated as Oak-pine Forest of the Soil Conservation Service, particularly the map prepared by Thornthwaite.

The more common trees of the combined types are Shortleaf Yellow Pine (*Pinus echinata*), Loblolly Pine (*Pinus Taeda*), White oak (*Quercus alba*), Blackjack oak (*Quercus marilandica*), Post oak (*Q. stellata*), Spotted oak (*Q. Shumardii*), Willow oak (*Q. phellos*), Black locust (*Robinia Pseudo-Acacia*), Black hickory (*Carya Buckleyi*), Basswood (*Tilia americana*), and Sugar maple (*Acer saccharum*). Huckleberry (*Vaccinium vascillans* var. *crinatum*), Mock orange (*Philadelphus pubescens*), Pink azelia (*Rhododendron roseum*), Gooseberry (*Grossularia* sp.), Bladder nut (*Staphylea trifolia*), and Spice bush (*Benzoin aestivale*), are the more common herbs and shrubs. Big bluestem (*Andropogon furcatus*), is common over the entire type, particularly the drier portions.



Plate XIV—Typical view of uncut Oak Pine Type in McCurtain County.

There are approximately 5,112 square miles of this combined type of which 4,992 has been mapped as Oak pine and 120 as Loblolly pine-hardwood type. Included within the condition are the major parts of McCurtain, LeFlore, Latimer, Pushmataha, Atoka, and parts of Pittsburg and Haskell counties. The major part of this type has been cut for timber and second growth is making a good game cover. Coal mining is confined almost entirely to the northern part of Latimer and LeFlore counties. This industry appears to not greatly affect game populations at the present time, other than through the population concentrations which are maintained.

CLIMATIC CHARACTERISTICS

Map A shows that This entire condition lies within that climatic province characterized as humid, mesothermal and adequate precipitation at all seasons. The average annual precipitation varies from about 42 to 56 inches. The growing season in the northern section of the type is around 200 days and in the southern portion varies from 210 to 230 days. Severe weather is seldom a factor in game depopulation here, other than as may be indirect.

PHYSICAL CHARACTERISTICS

This type is characterized by some of the more rugged relief of the state. Within this type are two principal east-west trending

mountain chains, known as the Kiamichi Mountains and the Winding Star Mountains. South of these ranges are smaller mountains which are included within the Oak-pine Forest Game Type. Rich Mountain, highest of the area, reaches an elevation of 850 feet above the valley floor, and others rise as much as 1,800 feet. Principal drainage here is the Kiamichi, Little, and Mountain Fork Rivers. These streams are clear and many of the smaller branches are spring fed. Over most of the type the soils are thin and poorly drained. They are derived, for the most part, from sandstones and shales. The slopes are littered with boulders, although the valley soils are fine textured.

LAND USE CHARACTERISTICS

Due to the generally infertile soils and rugged topography, only around 15 per cent of this type is in farms, of which only 11 per cent is in actual crop production. The rest is in woodland. Lumbering, coal mining and farming are the principal land use activities. The lumber industry is at a low peak. During the early 1930's there were four large sawmills operating here. Two were located at Broken Bow, one at Wright City, and one at Pine Valley. At present there is only one large mill in operation at Broken Bow.

Agriculture, insofar as we are able to determine, must be treated as a permanent land use and perhaps a somewhat stable one, if compared to farming operation in

showing the increase seen with bobwhite quail.

WILDLIFE CHARACTERISTICS

Oklahoma is fortunate in having this large area of Oak-Pine Forest Type within the State. It offers excellent opportunity for the restoration of many important game and furbearing species. The major portion of the State's deer population, and the only remaining native wild stock of wild turkey are found here. Bobwhite quail, cottontail rabbits, striped skunk, spotted skunk and opossum are found mainly around the small farms and clearings. Deer, wild turkey, raccoon and fox are found in the wilder portions. Here the fox squirrel occupies the



Plate XV—Showing bottomland surrounded by Oak-Pine Type in Southeast Oklahoma.

more western sections. Here, cotton is the principal cash crop and considerable corn is grown for both cash and grain. The average farm is around 75 acres in size and of \$2,240.00 in valuation. About 65 per cent of the farms are tenant operated and the population density for most of the area is about five to ten persons per square mile.

Lumbering has been the greatest factor of man's activity influencing game populations here. Cutting of the timber has opened up timber stands and allowed dense undergrowth to develop. Early literature clearly shows that the present day bobwhite populations are definitely above those of the days before timbering. Too, habitat has been improved for deer and other species, but other factors operating have kept these from

mountains and ridges, while the gray squirrels are found on the bottomlands. Turkey, deer, beaver, raccoon, mink and otter, are species which should be investigated here.

TALL GRASS GAME TYPE

DEFINITION

The Tall Grass Game Type occupies most of the best of the agricultural soils of Oklahoma and, with the exception of the Arbuckle Mountain and Osage areas is characterized by clean cultivation and low game potentiality. On the basis of original vegetation this type includes the **Big bluestem subtype**, the **little bluestem subtype** and probably a portion of the eastern edge of

the **mixed grass ecotone type** of Whittaker and Osborn (1939).

For the most part the natural vegetation consists of a mixture of such species as big bluestem (*Andropogon furcatus*), little bluestem (*A. scoparius*), Indian grass (*Sorghastrum nutans*), Switch grass (*Panicum virgatum*), and Silver beard grass (*A. saccharoides*), in the eastern portions of the type, with a gradual increase of such species as buffalo grass (*Buchloe dactyloides*), blue grama (*Bouteloua gracilis*) and side oats grama (*B. curtipendula*). Continued grazing has removed the tall grass species from the composition of the western portion of the type leaving only the short grasses.

become more pronounced with the more complex network of drainage.

The soils of the type west of the central cross timbers have their origin from shales and clays of the permian Red Beds and range from light sandy loams to heavier silt loams and clays. In northeastern Oklahoma the type is supported mostly by residual soils formed from weathering of limestones, fine grained sandstones and shales.

CLIMATIC CHARACTERISTICS

Climatic peculiarities do not characterize the Tallgrass Type insofar as Oklahoma is concerned. It is more humid than the ad-



Plate XVI—Typical tall grass Type condition in Grant county. Note total absence of game cover due to aridity and fertility of soil.

This is the largest game type in the state, comprising around 20,500 square miles occupying generally a belt from north to south just east of the Post oak Blackjack Type. The Cherokee prairie, a sizeable area, is located in northeastern Oklahoma.

PHYSICAL CHARACTERISTICS

The topography of this type is from flat to gently rolling. However, the pronounced topographic feature of the type is the Ar-buckle Mountain area which is fairly rugged. The north portion, characterized by its general flatness, includes Woods, Woodward, Alfalfa, Grant, Kay, Garfield and Blaine counties. As one progresses southward and eastward the land irregularities

joining Mixed Grass-eroded Plains Type on the west, but differs from the Post Oak-blackjack Type in other respects.

This type is partially represented in all three of the major climatic provinces of the state, but falls largely in that one characterized as sub-humid, mesothermal and moisture deficiency at all seasons.

The average annual precipitation for the type varies from 42 inches on the east to 26 inches on the west, with the bulk of the type falling between 28 inches to 38 inches. An annual snowfall of around 8 inches occurs over the type, with around 14 inches in the northwest.

The growing season is from 190 days on the north to 230 days in the Red River Valley in Marshall county.

Throughout the intensively farmed areas, seasonal floods overflow the bottomlands of this condition, forcing game to seek the sparsely covered uplands. Continued erosion has silted up many of the stream beds and, along with trampling by cattle, the game cover in many areas is seriously reduced.

LAND USE CHARACTERISTICS

As a result of fertile soils, generally sufficient rainfall for small grains, and favorable topography, the tall grass game type is essentially an agricultural game condition.

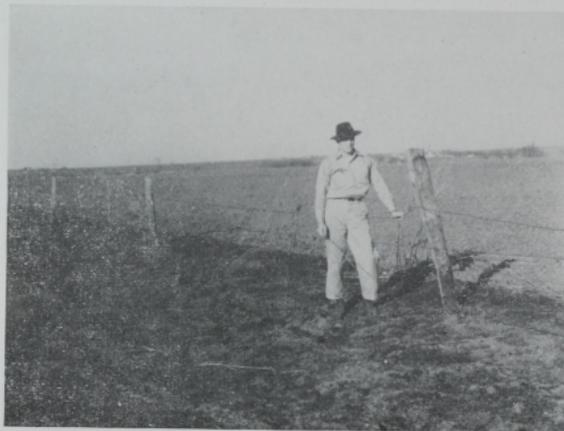


Plate XVII—Roadside burning damages bobwhite cover on the Tallgrass Type.

With the exception of the mountainous areas, the type west of the cross timbers is approximately 80 per cent cultivated. Throughout this portion of the type, wheat is the principal crop in the north, while cotton ranks first in the south. Corn is a ranking crop in the northeastern portion with hay a close second. The Osage grasslands are used very little for crop production, but largely for pasture.

Farm tenancy for the tall grass game type, from north to south across Oklahoma is around 35 per cent in Garfield, 49 per cent in Craig county, as compared to 60 to 70 per cent in parts of southern Oklahoma. The average farm size varies from 80 acres to several square miles.

WILDLIFE CHARACTERISTICS

Most of the wildlife of this type is confined to the stream border cover which has, in most cases, been mapped as **Bottomland Forest Type**. However, the badger striped skunk, greater prairie chicken and coyote are the principal species utilizing the true tall grass uplands. Throughout the northern portion of the type west of the central cross timbers, little is offered in game cover. However, eastward and southward better cover and relatively high populations of small game are found. Johnston grass has become important for bobwhite where it has not developed too rank a growth.

Due to several factors, mainly the tremendous expense involved and the nearness to

good game country, it is doubtful if an extensive management program is justified for this type.

THE MIXED GRASS ERODED PLAINS GAME TYPE

DEFINITION

The Mixed Grass Eroded Plains Game Type includes some 8,500 square miles generally located across the western one-fourth of the State, excluding the Panhandle counties. A mixture of both tall and short grass species characterizes the original vegetation pattern with variation in the composition on the western and eastern edges where this type merges into the other two associated

grasslands. There has been some difficulty in setting up a condition here comprising the bulk of what some authors have classified as Mixed Grass Ecotone Type and still maintaining some consistency as to game habitat conditions. Throughout, where doubt existed as to the true nature of the condition, topography served as a determining factor in the present work. The Mixed Grass Eroded Plains Game Type is characterized by a mixed grass composition and a definite ravine relief which is generally wooded. It is part of an extensive area of similar vegetational conditions extending as an overlapping of tall grass species from the east, with short grass species from the west northward across the United States.

however, wide differences in temperature, situated as it is across the state from north to south. Snows and rains are of importance here as seriously affecting such game species as bobwhite and mourning doves. The snows usually occur late in winter, from the last of February to March after the winter foods have been seriously depleted. Too, since most of the cover is located in ravines and bottoms, sudden floods and deep snows are detrimental. Drouth periods are serious throughout the type in preventing the development of sufficient protective cover and sometimes winter food. However, it appears that bobwhite coveys are well adapted to the lack of live water since they are often found from two to three miles from water holes.



Plate XVIII - Mixed Grass Mesquite Plains

In the southwest part of the State, and also in Major and Blaine counties are extensive areas of this type covered with mesquite, which, for the most part, has been mapped separately on the type map. Scaled quail were once found in the southwest portion of this condition in considerable numbers.

CLIMATIC CHARACTERISTICS

The Mixed Grass Eroded Plains Game Type lies entirely within the climatic province characterized as subhumid, mesothermal, and deficient moisture at all seasons. The type lies between the 22 and 30 inch rainfall belt, and, roughly, has from 190 to 220 frost-free days a year. There are,

Here at present the vegetational composition is composed for the most part of short grass species, buffalo grass (*Buchloe dactyloides*), and blue gramma (*Bouteloua gracilis*), with side oats gramma (*Bouteloua curtipendula*) abundant in places. Little blue stem (*Andropogon scoparius*), where moisture is sufficient and grazing not excessive, is an important species in the type.

PHYSICAL CHARACTERISTICS

Topography has a great influence on game populations within the type. Practically in all cases small game cover is confined to the deeply eroded ravines and brushy canyons, typical of these shaley erodible soils of western Oklahoma. Repre-



Plate XIX—Showing the well wooded stream courses in the Mixed Grass-eroded Plains Type, Washita county.

sentation of the better portions of the type are found on the Cimarron watershed in Harper, Woodward and Major counties. In Woodward county the Cimarron river has cut its bed some 400 feet below that of the southlying North Canadian river, which has resulted in a very pronounced relief. Too, the heavy textured soils and geological materials encourage erosion by the high per cent of run-off in precipitation. Throughout eastern Roger Mills, western Custer and Washita, and southeastern Beckham county,

the type is best illustrated by the rough broken land.

With the exception of the mountainous areas, most of the soils are developed from fine grained sandstones, shales and clays of permian age. The presence of gypsum is characteristic of much of the broken land.

LAND USE CHARACTERISTICS

The flat lands of this type are about 75 per cent under cultivation, while the rough



Plate XX—Showing the deeply dissected plain of the Mixed Grass Eroded Plains Type, Woodward county.

broken land is probably not more than 10 to 15 per cent in cultivation. The average farm size is around 450 acres, being larger than on more easterly located types. Approximately 40 per cent of the farm families are tenant farmers, of which around 30 per cent remain on the same farm one year or less. Most of the streams are silted and vegetation choked out on flat lands and, due to the large acreage under single operation, conservation methods are not as closely observed here as elsewhere. Much of the land is now abandoned due to the past drouth and low farm prices. The principal crop in the north is wheat and in the south cotton and grain sorghums.

WILDLIFE CHARACTERISTICS

The principal game species found within this type are mourning dove and bobwhite quail. Cottontails are abundant along stream borders and jack-rabbits and coyotes offer much sport to those running hounds. Furbearers are abundantly represented only in that section of the wooded ravines. Raccoon and mink are extremely scarce throughout.

Bobwhite populations here show a definite seasonal shifting. Studies carried out here show that birds nesting on the uplands

move to the canyons or better adjacent types for the winter months. This often results in local concentrations and sometimes in serious loss. Lesser Prairie Chickens were once found in abundance on the type, particularly where it adjoined some of the sandy grasslands. It is doubtful if even under the most moderate grazing pressure they could establish themselves here again because almost any use destroys the taller grasses and cover which seem essential to their survival.

Most recommendations on this type probably should be in conjunction with ravine and stream improvement on the ranchlands. The widespread establishment of farm ponds throughout this type offers much in the way of game habitat improvement.

THE STABILIZED-DUNE GAME TYPE

DEFINITION

This type was set up to include the heavily vegetated sand-dunes which occur on the north sides of the Cimarron and North Canadian rivers in northwestern Oklahoma. The total area of the type is small, being around 368 square miles. Some workers have not recorded their findings in sufficient detail to consider this condition separately from



Plate XXI—"Blowout" being stabilized by invading vegetation after denudation by overgrazing. Result of fencing in Quail management experiment.

1910 dropped to 9.72 inches. During the 1939 season there was around 11 inches of rainfall and the following year a total of better than 45 inches in certain areas. The average rainfall is between 24.26 inches with most of the fall in the months of May, June, July and August. The growing season varies from 190 to 220 days. Most of the type occupies the climatic province characterized as subhumid, mesothermal, and insufficient rainfall at all seasons.

Such variations in moisture conditions result in a decidedly unstable environmental state for game species. Associated with overgrazing, improper agricultural practices and burning, the excessive precipitation increases soil loss through water run-off, and the

drainage. Most of the soils of the type are hummocky to rolling light textured soils, derived mainly from parent material of Quaternary or Tertiary age.

LAND USE CHARACTERISTICS

This part of Oklahoma was opened for settlement about fifty years ago. The land was settled in 160 acre plats with no consideration given the capacity of the land to support such a dense human population. This resulted in crop failure for a large number of early settlers, since the acreage was too small for either farming or cattle raising. What followed was an intense use of the soil, and much land unsuited for cultivation was broken out and the pastures overgrazed.



Plate XXV—Old field "blowout" caused by wind erosion of cultivated sandy soils.

long periods of drouth retard vegetational growth and encourage wind erosion. Localized areas here show the most pronounced erosion by wind seen throughout Oklahoma, though much of the type has not suffered seriously from this cause.

PHYSICAL CHARACTERISTICS

Topography of this type has a low broad rolling relief, the broad slopes dotted with small hills of sand on which the characteristic motts of oaks are found growing. The oaks in these motts reach a height of from 2-8 feet and grow in circular clumps of around 10-12 feet in diameter. Very little rough broken land is included within the type since the deep sandy nature of the soils discourages development of a rugged

World War I did much to further this use. Throughout the northern part of the type in Woodward and Ellis counties approximately 90 per cent of the land is again in pastures. However, the evidence of cultivation may be seen on practically every section. Farther south in Roger Mills, Beckham and Harmon counties around fifty per cent is in cultivation, although the Soil Conservation Service has done much to promote a more wise use of the land.

Around fifty per cent of the farms are operated by tenant families of which more than one half remain on the same farm one year or less. Principal crops in the north are grain sorghums. Broomcorn once ranked high here. In the south cotton comes into

PHYSICAL CHARACTERISTICS

The type has a distinct dune-like relief throughout, usually forming a pattern of alternating rows of dunes and valleys parallel with the course of the associated south-lying rivers. Game takes advantage of this feature, particularly during prolonged cold and wet periods. Soils of this type are, for the most part, of a deep loose sandy nature and subject to blowing where vegetational protection is removed. Agriculturally they are of very little value.

LAND USE CHARACTERISTICS

What little cultivation is found here is confined to very small fields of grain sor-

Bobwhite quail often concentrate here coming from surrounding types during severe weather and late winter. It appears that much of the winter population of this type is produced on the adjoining uplands.

THE SHINNERY-GRASSLAND GAME TYPE

DEFINITION

The Shinnery-Grassland Game Type in the western tier of counties represents the eastern edge of a similar condition found throughout portions of the Texas Panhandle and eastern New Mexico. The condition is characterized by a low growth of several species of oak (*Quercus spp.*) intermixed with



Plate XXIV—Erosion on shinnery type soils produced by removal of vegetative protection through heavy grazing, drought and cultivation

ghums between the dunes on tighter soils. The greatest use is for grazing. In recent years goats and sheep have been introduced here, resulting in extreme local overgrazing, particularly in the case of goats. When the brushy vegetation is destroyed the sand is allowed to blow and eventually results in sizeable areas of worthless land.

WILDLIFE CHARACTERISTICS

This is the best game type of western Oklahoma. It consistently supports some extremely high bobwhite populations. Cottontail rabbit and fox squirrel are generally abundant. Furbearers are well represented and white-tailed deer are found in very small numbers throughout the type.

the tall grasses of the western sandylands. At present little bluestem (*Andropogon scoparius*) predominates. Shorter grasses, however, come in on tighter soil areas. An approximate total of 1,173 square miles of this type has been mapped for Oklahoma, principally in southwestern Woodward, central Ellis, western Roger Mills, Beckham and northern Harmon counties. It is best correlated with the various shinnery grassland conditions defined by Osborn (1940).

CLIMATIC CHARACTERISTICS

The area occupied by this type is characterized by an extremely unstable climate, particularly as regards precipitation. In 1905 the average rainfall was 38.6 inches and in

shift of bobwhite from upland nesting grounds to bottomland and farmland winter cover on this type, the same as is described for the other upland types in western Oklahoma.

THE SANDSAGE-GRASSLAND GAME TYPE

DEFINITION

This game type was set up to include all of the sandy grasslands on which sand sage (*Artemisia filifolia*) forms an important part of the ground cover. This species is not found in eastern Alfalfa and Grant counties to any appreciable extent. However, the condition here so closely approaches that of the true sand sage that it was included within the type.



Plate XXVIII—Typical view of Sandsage Type in southwest Oklahoma.

The type is found throughout the northwestern part of the state, mainly on the north sides of the principal streams, and includes some 2,600 square miles.

The characteristic plant species are sand sage, associated with which are sand plum (*Prunus* sp.), skunkbrush (*Rhus trilobata*), hackberry (*Celtis* sp.), Little bluestem (*Andropogon scoparius*), big bluestem (*A. furcatus*), sandhill bluestem (*A. halli*), and Indian grass (*Sorghastrum nutans*). Representatives of the short grass species are typical of the short-grass plains area, and are common on the tighter soils. Retired fields and all marginal conditions support an abundant growth of weedy annuals and are usually in close association with woody cover species which persist here.

In part, this type corresponds with the sandhill bluestem classification of the Soil Conservation Service, the western Andropogon Associes of Bruner, and sand areas of the Mixed and Shortgrass Districts of Blair and Hubbel.

CLIMATIC CHARACTERISTICS

The bulk of this type lies within the climatic province characterized as subhumid, mesothermal and moisture deficiency at all seasons, but overlapping on the west into semi-arid, microthermal climatic conditions. The type extends from the western boundary of Cimarron county, with an average annual precipitation of 15-17 inches, eastward approximately to the 28 inch rainfall belt. The

entire type experiences from 180 to 200 growing days a year.

Periods of drouth under the present land use have resulted in a serious depletion of game cover on the pasture lands, particularly since grazing loads are seldom lessened during these times. Recent wet seasons of 1942-43 have, however, contributed much toward a rapid recovery of the vegetation. Heavy snows, especially in the northwestern portion are often of sufficient intensity to seriously damage small game populations.

PHYSICAL CHARACTERISTICS

The entire type is characterized by a rolling to dune-like relief. However, that portion level enough for cultivation has been some-

what leveled by the continued use and wind erosion.

Surface drainage is not well developed, due to the porous nature of the soil. Where streams do occur, however, they develop a luxuriant vegetation.

The soils supporting the sand sage grasslands are, for the most part, developed from Quaternary parent material which is found overlying the Permian red beds. Some recent expansion of the type has resulted from the moving sands of cultivated fields and closely grazed pastures.

LAND USE CHARACTERISTICS

From 40 to 50 per cent of this type in cultivation, largely to wheat and grain sor-

that described for the other upland types within this part of the state.

This type offers opportunity to do some of the most effective game management in western Oklahoma. Often any soil disturbance results in an abundant food production for small game, and the permanent cover of sage brush, scattered plum and sumac makes for excellent game habitat under moderate use.

THE SHORT GRASS-HIGH PLAINS GAME TYPE

DEFINITION

The Short Grass-High Plains Game Type is found mainly in the three panhandle coun-



Plate XXIX—These hunters got their limit of bobwhite. Showing moderately grazed, unburned Sandsage pastureland in Harper county.

ghums. The remainder of the land is used for pasture land on which cattle are grazed. The average farm size is around 385 acres, with the majority of the tracts being either 360 or 640 acres in size. Rural population densities for this type range from 5 to 10 persons per square mile. Approximately 40 per cent of the land is operated by tenants.

GAME CHARACTERISTICS

The principal game species of the sand sage grassland type are the bobwhite quail, lesser prairie chicken, mourning dove, and cottontail rabbit. Scaled quail are found in the western panhandle counties. Bobwhite here do much seasonal shifting similar to

ties and western Harper, western Woodward and Ellis counties. This portion of Oklahoma is but a small part of a vast extent of similar grassland reaching between the tall grass prairie and the Rocky Mountains from central Texas north into Canada. For the most part the type is restricted to the higher Tertiary materials throughout the area. There are approximately 1,127 square miles of the type in western Oklahoma.

The original vegetation of the high plains type consisted mainly of buffalo grass (*Buchloe dactyloides*), and blue grama (*Bouteloua gracilis*), but in places bluestem (*A. scoparius*), wire grass (*Aristida*), and side oats grama (*Bouteloua curtipendula*) occur. Other plants such as prairie clover (*Psoralea tenui-*

flora), partridge pea (*Chamaecrista* sp), blazing star, day flower, bush morning glory, and gumweed appear on more shallow soils. In the wallows or sinks, smartweed, ironweed, dcor weed and snow-on-the-mountain are found. Cultivated fields support russian thistle, sunflower, cockle burr, lambs quarter, bindweed, ragweed and grassbur. *Opuntia* cactus has appeared as a result of close grazing on some pastureland of the type.

CLIMATIC CHARACTERISTICS

The climate of the Short Grass Game Type is characterized by limited precipitation of irregular seasonal distribution, a high rate of evaporation, low relative humidity;

PHYSICAL CHARACTERISTICS

The area is an extensive plain with the gently sloping smooth lying surface interrupted by breaks on the larger stream borders. Natural depressions known as "sinks" or "playa lakes" are scattered over much of the heavier soils.

Topographically these "high plains" are in a stage of extreme youth and drainage channels have not developed. Under the natural grass cover, most of the rainfall was absorbed in this soil or flowed a short distance into one of the sinks, where is evaporated or percolated downward to the ground water level.



Plate XXX.—Abandoned farmstead on Short Grass-High Plains Game Type. Serves as headquarters for a large covey of Scaled Quail.

a high average wind velocity; hot summer days followed by cool nights; and moderate winters with occasional severe cold spells of short duration. Normally most of the rainfall occurs in the late spring and summer months. A considerable amount of the moisture falls as sudden torrential rains resulting in heavy run-off on the tight land of some slope.

The growing season extends from 180 to 190 days. The average annual rainfall runs from 17-24 inches. High summer temperatures of 112 degrees have been recorded at Hooker, with a mean annual temperature of 55.7 degrees.

Geologically the material supporting this type consists of an apron of debris extending eastward from the Rocky Mountains, having been deposited during Tertiary times.

The soils are generally fertile, having developed under a grass cover and comparatively low rainfall. Nitrogen content is high and very little leaching has taken place.

LAND USE CHARACTERISTICS

During the latter part of the nineteenth century when this type was first settled very little land was cultivated. Settlement began as early as 1880 when ranches were established along streams and other sources of water.



Plate XXXI—Russian thistle collected against barbed wire. Scaled Quail utilize these for fall cover.

Most of the farm development took place after 1900 when the farmers took homesteads and began breaking the sod. The early attempts were sporadic and some areas have had as many as three influxes of farmers to the present date. The most extensive crop production took place just after World War I, due to the high farm grain prices. In recent years use of heavy machinery has stimulated large scale farming, and most of the land suitable for cultivation has been broken.

The following outline incident of cropping in Cimarron county illustrates what happened throughout the entire type. Many settlers left the country between 1908-1912. There were crop failures between 1912-1920. The years between 1920-1923 were so dry that there was barely sufficient feed for livestock. In 1926 there was a bumper crop, in 1927 a complete failure and, since then, about three or four fair crops and the rest poor or failures. Since 1932 the area has



Plate XXXII—Showing absence of winter game cover along highway in Short Grass High Plains Game Type, Texas county.

suffered much from extreme drouth, dust storms, crop failures and low prices.

Around 50 per cent of the type is under cultivation. The following table shows these percentages for the three principal counties of the type:

County	Cultivation	Idle Land	Pasture
	Per cent	Per cent	Per cent
Cimarron	28.9	10.9	60.2
Texas	61.3	5.1	33.6
Beaver	50.8	3.9	45.3

The 1930 census reports show around 38 per cent of the farms being operated by tenants. This is rather misleading since many farmers owning land find it necessary to rent surrounding land, due to the owned

from the river bottom areas, and seem to be increasing in good number.

Formerly vast herds of antelope and buffalo ranged over this area. Some thirty antelope are at the present found on the type north of Keyes.

Scaled quail seem to hold the greatest promise for restorative work in this area. However, shelter belts have greatly increased nesting sites for mourning doves.

Further investigations may show possibilities for increasing antelope populations on the type. Yet it is extremely unlikely that populations sufficient to warrant hunting can ever be had.

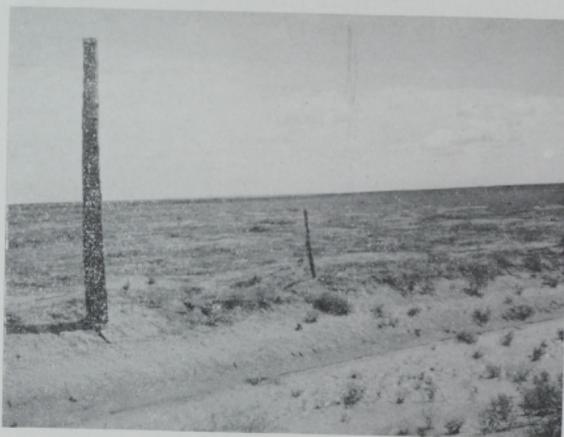


Plate XXXIII—The beginning of recovery of Short Grass High Plains Type, denuded by wind erosion. Note abundance of young sprouts of Russian thistle.

acreage being small. Tenants here appear to have reached a higher per cent of permanency than elsewhere. In Beaver county 31.4 per cent of the tenants have lived on the same farms five years or more, with 27 per cent remaining less than one year.

Wheat and grain sorghums are the principal crops throughout the entire type condition.

WILDLIFE CHARACTERISTICS

Game species here are scaled quail, mourning dove and the New Mexico cottontail. Bobwhites are found along the denser cover of the major streams where other type conditions are found. Pheasants, too, are found on the shortgrass condition, coming

THE PINON-JUNIPER-MESA GAME TYPE DEFINITION

The Pinon Juniper-Mesa Game Type is characterized, in the main, by the mesa-like topography. The type is limited in Oklahoma to the extreme northwest corner of Cimarron county comprising 363 square miles, of which 87 square miles support the true pinon-juniper vegetation. The remainder of the type is sufficiently similar as to warrant its inclusion within the total consideration.

The principal vegetation of the area is the pinon pine (*Pinus edulis*), juniper (*Juniperus monosperma*), thicketleaved hackberry



Plate XXXIV—Aerial View of the broad, level valleys and picturesque "Mesas" of the Pinon-Juniper-Mesa Game Type in northwest Cimarron county.

(*Celtis reticulata*), cholla cactus (*Opuntia* sp.), and scrub oak (*Quercus undulata*) and western yellow pine (*Pinus ponderosa*) is found in limited areas. The grasses found here are typical of the shortgrass high plains game type, consisting mainly of buffalo grass (*Buchloe dactyloides*), blue grama (*Bouteloua gracilis*), and hairy grama (*B. hirsuta*), with some tall grass species growing on the slopes in places.

CLIMATIC CHARACTERISTICS

The pinon-juniper game type is entirely within the climatic province characterized as semi-arid, microthermal and moisture deficiency at all seasons. Very little is known about the effects of the fluctuating climate here. However, it appears that such lack of stability is normal and such factors as drouth, of somewhat regular occurrence, and human activity, must be carried on here, recognizing it as such. The annual aver-



Plate XXXV—"Mesa" influence serves as important place in Scaled Quail environment in northwest Cimarron county.



Plate XXXVI—Typical view of Pinon-Juniper-Mesa Game Type west of Kenton, Oklahoma



Plate XXXVII—The valley of the Cimarron River from atop "Black Mesa" in Cimarron county, Oklahoma.

age precipitation is 17.9 at Kenton and varies much from year to year. The length of the growing season is 179 days, with an annual average temperature of 54.8 degrees. Extremely cold spells occur in winter, though they usually are of short duration.

PHYSICAL CHARACTERISTICS

The broad valleys of the Cimarron extend in all direction of the tributaries and end abruptly at the base of the mesas, resulting in an extremely rugged relief. One important topographic feature, the "Black Mesa", is capped with highly resistant basalt and has an elevation of around 5,000 feet.

Soil development is at a minimum here with the exception of the valley floor. The Dakota sand stone of the Cretaceous system is the escarpment forming material and results in mesas throughout the type rising around 500 feet above the floor of the valley.

LAND USE CHARACTERISTICS

Most of the area of this type is state-owned and leased by fairly large operating

cattle raisers who actually may own but a small part of each ranch. Very little of the type is in actual cultivation and the principal use is for grazing of cattle and sheep. Irrigation of the small valleys, as well as that of the Cimarron, has resulted in recent years in more cultivation of the flat lands.

GAME CHARACTERISTICS

Game species found on this type are the scaled quail, black-tailed deer, and New Mexico cottontail. Bobwhite and ring-necked pheasant are fairly common on the bottomlands, associated with the mesa condition. Other animals fairly well confined to the type, but less commonly known over Oklahoma as a whole, are the hog-nosed skunk, porcupine and rock squirrel.

The area is too small for serious consideration insofar as the hunting sportsman is concerned, with the possible exception of the scaled quail. However, recent indications of the possibility of the area being made into a State Park should encourage caring for the other species here since they are rather uncommon for Oklahoma.

CHAPTER III.

THE BOBWHITE QUAIL

The bobwhite quail is at present the most important game species in Oklahoma and represents an asset of considerable proportions to the people. For this reason it was believed at the outset of this work that the bird warranted considerable attention in the survey.

Problems concerning relative population densities, conditions of local existence, survival and effects of released hatchery stock, functions of large and small refuges, seasonal shifting of populations, fluctuations in population numbers, and habitat improvement as a means of bobwhite increase, were all briefly touched upon during the course of the survey. As may be expected, no definite conclusive overall treatment of the accumulated data is possible. In most instances, however, it is believed that a number of important trends were discovered and in general that sufficient information has been gathered to establish the ground work for a sound statewide bobwhite quail program for Oklahoma.

Throughout the various investigations concerning bobwhite quail the workers have been particularly impressed with the complexity of factors operating toward this species' existence in Oklahoma. This is made doubly interesting since the effects of white man's culture in this state dates from such a recent time that they may be more or less measured in terms of their influence in altering the original game habitat. Bobwhite quail, living as it does in Oklahoma under such a wide variety of conditions, made so by differences in native plant composition, by agricultural differences, by lumbering, oil and gas recovery, and by climatic and soil differences, presents problems which may be classified in such a manner that subsequent work may be much simplified. An attempt has been made to do this in the following report. However, it is expected that a better understanding of the importance and functions of these factors may be had as investigations are continued.

HISTORICAL

Much time was spent in gathering information toward correlating past populations of bobwhite as indicated in the records of the early explorers and settlers, with the

development of land use in Oklahoma. Due to the lengthy nature of this material, it will be only summarized in this report.

There is much evidence that the pre-settler bobwhite populations were not extremely high as is commonly believed, and particularly does this seem to have been true throughout the true prairies and true forests. Good populations did exist on the margins of these conditions, but it may be readily seen that large areas of such game type conditions as the Oak-Hickory, the Oak-Pine Forests and the Tallgrass Prairies in their original undisturbed state, had little to offer in the way of bobwhite habitat. Records show the populations are higher today throughout the Oak-Hickory and Oak-Pine types than they were prior to cutting of timber and cultivation. Populations for the northern portion of the Tallgrass type, however, are undoubtedly lower today due to the clean type of cultivation practiced here. Nevertheless, the southern section of this type, where smaller fields and increased drainage pattern now allow for much more marginal habitat development, carries populations in excess of those of the undisturbed conditions.

There is little doubt but that the quail populations reached their highest peak immediately after the settlement of particular parts of the state. In western Oklahoma this appears to have occurred between 1895 and 1910, varying, however, according to the dates of land openings. In eastern Oklahoma the peak occurred somewhat earlier and actually has reached, at present, a population condition which shows little evidence of present change, since farming operations here are more stabilized than elsewhere in the state. In western Oklahoma quail densities were at first stimulated by the small field agriculture practiced by the first farmers, but with the increase in acreage brought about by the introduction of machinery during and after World War I, habitat was much reduced. This movement progressed toward a decrease up until about 1935, when the abandonment of farm land throughout the west, and particularly so on the sandier lands, tended to break the downward movement of populations. Due to the extreme fluctuations in numbers from year to year, this trend has been largely unnoticed except by the more careful observers. The abandonment of farm land, however, has resulted in much better habitat conditions throughout

the western portion of the state, and quail have increased since 1935 generally. In fact, contrary to much opinion, populations steadily increased throughout the drouth years. We can expect this upward trend to break and fall when the old fields have again become covered with native grasses such as the big and little bluestems, which gradually eliminate annual weed seed producers necessary to the diet of the bobwhite quail.

The bobwhite was a popular market bird in early Oklahoma and many settlers relied upon the money received from the sale of the birds for one of their few sources of cash.

The legislative control of quail hunting is of interest to mention. In 1895 the first game law was passed by the Territorial Legislature. It prohibited the killing of any wild in-

later, the bobwhite quail possesses such power of population recovery that the take for the market contributed only in a local and temporary effect. Low populations in any locality today cannot be laid to the effects of early market hunting.

PRESENT DISTRIBUTION AND ABUNDANCE

DISTRIBUTION

Today the bobwhite quail is present and shot to some extent in every county of the state. It occupies every game type with the exception of the Pinon-Juniper Type and even here coveys are occasionally found on the associated bottomlands. Only small portions of the Shortgrass-High Plains Game Type is



Plate XXXVIII—Quail Census crew—National Youth Administration boys.

sectorious bird except the quail and prairie chicken, and wild turkey could be shot between the first day of November and the first day of February of the following year. The act also prohibited the exporting of game from the Territory of Oklahoma. Since there was no enforcement body, the law was largely ineffective. In 1903 a new law was passed subjecting railway and express companies to heavy fines for receiving shipment of game. We have records from several old market hunters that, for awhile, game continued to be shipped out and was packed in suitcases and trunks and checked on tickets.

The effect of the early market hunters in depleting bobwhite populations has received much more attention than such practice actually warranted. As will be shown

found to support the species, and this is usually where other type conditions enter by the way of stream influence.

QUAIL CENSUS

One of the first requirements of a sound game management program for any species is the knowledge of the status of the species in terms of numbers. This was recognized as being important with bobwhite and, although it is obviously impossible to collect absolute population figures on such a widespread and abundant species, a practical means of keeping track of trends was necessary. Treatment in terms of birds-per-acre or coveys-per-square-mile figures appeared most usable for the present work, even though they may be slightly misleading at

first glance by the sportsmen readers. Nevertheless, this method of treatment has a distinct advantage over total absolute figures as will be seen later in the discussion.

Population densities for each of the game types (See Game Type Map) were determined by selecting representative sample census areas throughout the extent of each type condition. These census areas varied in size from 60 to 640 acres, but were largely of 160 acre size each, depending upon the nature of the particular condition to be censused. Bird dogs were used in most cases in arriving at the count, though Civilian Conservation Corps and National Youth Administration labor was used in some cases. Method of census was simply to flush and count every covey on the census area by walking with one or more hunting dogs by parallel strips, the width of which depended on the ranginess of the dog. Attempts were made to select an average representation of each of poor, medium and rich habitat condition of each Game Type. The importance of this type of census and selection is that it makes possible the prediction of the potentiality of any particular game type by assuming that the poor habitat conditions are capable, through improvement, of supporting either of those populations found on rich or medium conditions of the same game type. Knowing the "low", and "high", and the average of population densities for a type gives the worker a scale by which efforts at habitat

improvement may be measured, and very often supplies a basis of comparison by which the causes of the lows may be determined.

From the data collected from the field work with the type of census and selection described above, the following table has been constructed:

It will be noted that total numbers for the statewide population of bobwhite quail are given. It must be understood that while density figures expressed in bird per-acre ratios are essential and, for practical consideration, are accurate, these total figures at best represent only calculated guesses based on a mathematical average of the entire game type average population. Since these total figures are given, it is well to point out that the sources of error involved in their calculation are readily recognized by the workers, and that they are submitted merely because of the interest sportsmen and others have shown in total populations.

Since workers are at present unable to measure the extent of each type condition representing the various separate densities for a widespread and abundant species like bobwhite, the above table is presented as the nearest thing to an accurate total figure available.

TOTAL POPULATION

Table III shows the results of two fall censuses of 1940 and 1941 in Oklahoma. The

TABLE III.
BOBWHITE POPULATIONS FOR OKLAHOMA — 1941

GAME TYPE	Number Areas Censused	Acreage Censused	*Density	Range	Computed Average Density	Total Calculated Populations
Oak Hickory	11	2,640	2.2	12 8	4.6	516,000
Post-Oak-Blackjack	44	9,032	2.0	64 0	4.8	2,350,000
Tall Grass Prairie	17	4,060	3.0	0 0	6.9	655,000
Bottomland	8	1,080	3.3	10 6	4.2	522,000
Oak-Pine (1)	20	3,304	1.8	10 6	4.2	761,000
Oak-Pine (2)	15	325,120	2 6	33 6	24 0	
Stabilized Dune	8	2,580	1.2	2 0	1.8	131,000
Sand-Sage	13	3,815	4 0	16 0	14 0	119,000
Shinnery	4	800	4 0	64 0	8 0	94,000
Mixed Grass	8		10 0	0 0	30 0	216,000
Short Grass	2	660	8 0	0 0	0 0	
	165	353,211	1.2	0 0		

TOTALS

1. Fall Populations
2. Spring Populations—54% decrease
3. Maximum Population under Management

*Acres per Bird Density.

**Due to Fluctuations and Calculations.

***Only Approximate Calculations.

accompanying map shows these areas to be well distributed over the state with the exception of the three Panhandle counties where, for the most part, bobwhite is unimportant. A total of 150 sample areas were censused for bobwhite primarily, comprising 28,091 acres. However, the total area from which bobwhite census figures are available is 353,211 acres. This was made possible since census of other species allowed for making counts on bobwhite as well. Roughly the state appears to support between 5,500,000 and 7,000,000 birds during the early fall before hunting season. Consideration of the number of spring counts made, permits the calculation of a winter loss, due to various natural reasons and hunting, of approximately 54 per cent of the fall number. This spring count, discussed later, was made after the danger of loss from winter weather was passed and before the spring break-up of the birds for breeding. It serves to indicate the potential breeding density of the stock.

BOBWHITE QUAIL DENSITIES AND THE GAME TYPES

One of the most important values of the Game Type Map is that it permits census work and analysis of populations which would be impossible without such a classification of habitat conditions. This is clearly seen throughout the following discussion, where a close correlation between populations and type conditions is evident.

Census figures and field investigations show that the Stabilized-Dune Game Type of northwestern Oklahoma supports the highest density as well as the most consistent populations of all game types. However, allowances must be made here for the year-to-year fluctuations in numbers peculiar to the northwestern portion of the state. In spite of the relative lack of stability in populations, this type is probably not much exceeded in density anywhere in the United States. Its small size, however, makes it less important to hunters than some of the larger types supporting lower densities. On the Stabilized-Dune Game Type, populations of less than one bird per two acres were not encountered during either of the two census seasons. Records from hunters on this type tend to hold up these figures. Late winter concentrations of six birds per acre have been recorded by the workers. In one instance a total of 153 birds was found to range over not more than ten acres during a period from December to late February. Normal fall populations here are greatly

augmented by a shift of birds from the more sparsely covered uplands during severe winter weather. (See Table IV).

The Postoak-Blackjack Game Type is almost entirely potentially excellent quail habitat and is seen to support densities ranging from one bird per 2.0 acres to one bird per 64.0 acres, depending upon local land use. This is probably the most important condition of quail habitat in Oklahoma, not only because habitat improvement is an easy matter, but because it appears to support the heaviest hunting pressure of the game types.

The Tallgrass Prairie Game Type presents some peculiarities insofar as bobwhite populations are concerned. Throughout Woods, Alfalfa, Grant, eastern Kay, and south to northern Caddo, Comanche and Grady counties, there is very little uncultivated land and the usual marginal cover is almost totally lacking. Quail here are limited to the drainage influence. Eastward and southward the more complex network of drainage results in some very good quail habitat. Generally the principal wheat growing section of this type supports poor small game conditions and, under its present cropping value, development of habitat would likely prove too expensive for consideration. Populations on this type were found to range from a high of one bird to three acres to large areas supporting no birds at all.

Oak-hickory Game Type populations are seen to have varied from 2.2 to 12.8 acres per bird density. Agricultural practices of this type are mainly confined to the valleys and stream bottoms and are responsible for the higher populations of the condition. The recent trend toward berry raising is doing much to establish a better quail habitat throughout this type.

The Oak-pine Game Type shows much variation in densities due to local use of the type by people. Populations as high as one bird per 1.8 acres and lows of one bird to 33 acres have been recorded. Higher populations here are associated with timber cutting and the small field agriculture characteristic of the type. The more primitive sections of this type support the lower populations.

Other types show much the same variation in density as those discussed, and local land use appears, in the main, to be responsible for the differences within a type condition. The Mixed Grass Eroded Plains Type is not generally good quail habitat. Even moderate use here tends to remove cover

and food plants. However, the rough portions usually support good populations.

GENERAL FACTORS INFLUENCING ABUNDANCE

One cannot drive over Oklahoma without being much impressed with the great amount of disturbance which has been caused by man, and over a comparatively short time not averaging over fifty years. Within forty years after the opening of Oklahoma a serious erosion crisis has developed. The Panhandle, until recently, was aptly called the "dust bowl" and, according to soil authorities, the blackjack belt of central Oklahoma now constitutes one of the largest contiguous areas of serious gulying and sheet erosion to be found in the country. The Washita River was described by one early explorer as "the most beautiful stream in Oklahoma". It is now probably one of the ugliest examples of erosion and silting to be found. Throughout the timbered section of the state one must look long for areas of uncut, unburned and not overgrazed vegetation. Natural virgin conditions do not exist in Oklahoma. However, it is doubtful if, all things considered, the state can afford to return to such a condition of use on any but small parks and the like. Nevertheless, it must be emphasized that the bulk of the problem concerning game in Oklahoma can be traced directly or indirectly to land use by the human population. Game restoration in Oklahoma will not come until this relation of game to the land and its use is understood by those having the responsibility of game administration. It is not possible, nor is it likely ever to be possible in the future, that game restoration in this state, including bobwhite quail, can ever be planned on a "back to nature" basis. Improvement of bobwhite hunting must come through correlation of habitat improvement with local land use.

Throughout the survey care was taken to attempt to diagnose the principal influence on bobwhite populations. More often than not it has been found that the most influential factors, or those basic in effect, are those less recognized and less understood by the sportsmen. This has been particularly true with bobwhite. There is no doubt but that the entrance of human beings on the scene created the greatest upset in the original bobwhite environment. Due to a need of better understanding of these influences, portions of the state have been examined separately and the following analysis made. (See map—Bobwhite at end of chapter.) This

classification is usable in the practical sense and will be found necessary in any consideration of a game management program.

The area designated as Area 1, is characterized by annual fluctuation in populations which may be of considerable magnitude. Associated with this is a definite shift of birds from summer and nesting range to winter range of heavier cover conditions. The results of a three year study on this phase of quail ecology reveals that this seasonal shift from summer to winter range is intensified during winters of severe weather, indicating that it is a forced movement representing a seasonal adaptation to varied types of quail range. Table IV presents these data in tabular form where the correlation of shift magnitude with winter severity is seen. This movement tendency, as well as the associated up and down fluctuation in numbers, makes for extreme complexity in the study of quail ecology in northwestern Oklahoma. These are normal reactions for western range and are not met with in more eastern portions of the state. However, in any consideration of the game administration in the betterment of hunting, these influences must be seriously studied.

Although data from this area is much confused by these interacting factors, it appears that grazing in association with winter weather basically controls quail populations in this area. The farther north and west, the more pronounced these characters appear in the ecology of the species.

Area 2 is characterized by high land values, high crop productivity, cropping systems of clean fence rows, roadsides, lack of crop residue during winter months, and a general overall lack of quail habitat. The principal crop in the north is wheat and in the south cotton. High land values here and arability, make game habitat an economic impossibility, particularly when one considers that at no point are distances excessive to excellent quail country. Most development in this area would result in the establishment only of barnyard coveys with no material value to the hunting public. Associated areas of waste land are scarce and so situated that farm game management is generally impractical.

Area 3 of this classification is characterized by a relatively high bobwhite potential, the realization of which is controlled almost entirely by local land use. Here were found all degrees of quail density closely associated, being due to the extremely varied local

use and management of the grazing and cropping soils. Bobwhite habitat here is either present in sufficient quality or in such a condition of localized abuse that proper management at low cost would result in satisfactory populations. Quail populations here are stable and do not exhibit the shifting and fluctuation seen in Area 1. The species occupies an important place in the farm game picture in this area and on properly maintained farms reacts readily to habitat improvement.

Area 4 is similar to area 3 except that timber cutting is the most important basic factor, which is followed in importance by the small field agriculture but not so extensively developed as in Area 3 due to the rough general topography. Clearing of the forest and allowing the undergrowth to develop here is responsible for the better populations of quail found. This is of course enhanced by the influence of the scattered small fields farmed.

SPECIFIC FACTORS INFLUENCING BOBWHITE ABUNDANCE

Influencing factors widespread and general in character have been discussed on the preceding pages. The discussion here is to be limited to specific causes which may be distinguished from the general causes in that the present cases represent local loss, and are significant only locally, and that they usually result from one or a combina-

tion of the previously stated general causes. With sportsmen and others, it is these specific causes which receive the most attention, while the basic influence is often overlooked.

Studies into the specific causes of mortality in bobwhite quail were not an important part of the Survey. First the general high density of the species indicated that where cover and food were sufficient, losses of individual nature were not important, and, too, it was felt that the nature of the survey investigation called for a better understanding of the general picture, in which case specific studies would come in later and more detailed investigation. Nevertheless some data have been accumulated which may be presented here.

PREDATION

Predation as a cause of low quail populations actually receives more statewide attention than the facts warrant. Predation does occur, as it naturally would be expected to, and, although the total number of birds lost from this cause may be large, there is no evidence that the loss accountable to this factor is in any way material insofar as representing a material per cent of the fall population, or in effecting a decrease of shootable birds. Unfortunately, those who sponsor the control and destruction of certain wild predator species as being harmful to quail, almost always are motivated by

TABLE IV — BOBWHITE QUAIL
SHOWING TABULATION OF POPULATION CHANGES ON
GAIN AND LOSS CENSUS AREAS IN NORTHWEST OKLAHOMA

UPLAND CENSUS AREAS						BOTTOMLAND AND DUNE AREAS					
1939-40		1940-41		1941-42		1939-40		1940-41		1941-42	
Severe Winter		Average Winter		Mild Winter		Severe Winter		Average Winter		Mild Winter	
Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.	Sept. — Jan.
5	0	0	0	12	0	12	48	8	24	25	43
19	0	8	0	22	8	0	23	0	14	12	42
9	0	6	0	12	8	15	57	12	38	8	12
63	12	22	18	54	14	0	44	6	22	8	17
52	36	8	0	49	28	72	102	42	53	68	94
39	8	11	6	38	16	63	87	40	46	67	84
						63	139	34	72	71	93
187	61	55	21	187	74	230	500	142	269	259	385
Loss	126		34		113	Gain	240		127		126
% Loss	67.3		61.8		60.4	% Gain	104.3		89.4		48.6

evidence presented in single isolated cases and not on a study of effect on populations. Oftentimes the species chosen for destruction is one necessary to the quail environment and is one actually serving as a definite benefit to the birds. This is true of most of the hawks. Statewide programs for the control of hawks of any species are as yet based on misleading information and it is extremely doubtful if such a wide scale action is ever justified. Local control may prove necessary in some cases and may easily be handled as such particularly in the case of the "blue darter" of the Cooper's and Sharpshinned hawks. With most of the other hawks there is much general evidence that, due to the extremely high rodent population over most of Oklahoma's better quail habitat, these hawks are indirectly beneficial to quail through their efforts to control such animals as kangaroo rats, pack rats and rabbits. The rodent populations reach very high densities in some portions of the western sandy lands which may constitute a competition of some degree for late winter foods. The bulk of the food of most of the hawks of Oklahoma is made up of rodents.

Species often mentioned, and for which isolated cases of predation have been reported, are: coyote, fox, bobcat, eagle, all hawks, crows, ravens, pheasants, snakes, roadrunners, terrapins, skunks, opossums, raccoon and mink. It is obviously impossible, even should the evidence warrant it, to control all these species and, in this respect, food and cover development is recommended as the best predator control devised to date under these circumstances.

WEATHER

Weather conditions are important in the bobwhite picture, particularly throughout the western and northwestern portions of the state and on the stream bottoms of the Tallgrass Game Type. Seasonal floods are characteristic of much of the western two-thirds of the state. Game types influenced by this are bottomland, Tallgrass prairie and the Mixed Grass-eroded Plains. Overflowing of the bottomlands here results in forcing the bobwhite population to the sparsely covered uplands where they are exposed to weather and predators. This is particularly noticeable on the bottoms of the North and South Canadian rivers where the adjoining south-lying game types are generally poor bobwhite habitat. Spring floods here often appear to interfere seriously with nesting, but are probably more harmful during early

spring or fall when rains are accompanied with cold weather.

Drouth periods in the past, particularly when the lack of rain comes in the spring when moisture is necessary to develop a weedy cover and food supply, and when coupled with heavy grazing, often results in low fall populations. Almost always, particularly in northern and northwestern Oklahoma, severe winters are followed by low quail populations. During the late winter of 1939-40, a substantial loss occurred west of Alva and Fairview into the Panhandle. In many cases frozen birds were found throughout this area. Winter feeding, if extensive, would undoubtedly have saved many coveys here since very low temperatures are seldom of sufficient length to cause the death of birds by freezing alone. It appears that deep drifting snows so hamper the movement of birds that feeding is difficult and the resistance of the birds is lowered to where low temperatures are harmful.

Hail is sometimes destructive in western Oklahoma. However, since these storms usually occur in such narrow strips, birds are able to recover through their natural tendency to shift around at mating time. It has been found that the natural influx fills up such gaps, particularly during the spring months.

DISEASE

Despite the popular idea of the importance of disease, no evidence gathered during the course of the survey ever indicated the presence of disease as a factor in quail populations. Birds recovered during the winter of 1939-40, during a period when dead birds were found in snow drifts, are the only specimens the workers have been able to recover in the field and it was seen that these losses were not due to disease.

HUNTING KILL

The laws regulating quail hunting in Oklahoma are such that many people violate the bag limit. Although these violations are not of any particular injury to the populations themselves, it is regrettable that a change in regulation is not made. As the law stands, a person is allowed to take ten birds a day and not more than fifty in a season. A great many people hunt every hunting day of the season, which brings their total bag well above the limit allowed. Despite the reluctance with which such violations are admitted, it is known that over-

shooting the daily, as well as the seasonal, bag limits is fairly common in Oklahoma. Statistics are not available to show how important this take is, but it must be considerable.

On the opening day in 1939, a year of quail abundance, the workers interviewed nine hunters at the end of the day's hunt. All had overshot their limit to the extent shown in the table below:

SHOWING HUNTER RECORDS FOR OPENING DAY OF QUAIL
SEASON — 1939

No. Hunters	No. Quail Taken	No. Quail Lost	Average Hunting Time
9	136	14	3 hours
Average bag per hunter			15.1
Per cent of birds lost			9.3

These hunters were selected without their knowledge before the day's hunting, as representing average hunters and average citizens as nearly as possible. Laws and enforcement will not prevent this type of violation in quail shooting.

Far more important is a type of overshooting which may not be in violation of legislation but which may result in seriously reducing the stock. This is overshooting the population. It is common practice for hunters to shoot a covey as close as possible. In certain cover it is impossible to overshoot a covey, but in many instances in more open cover, a party of hunters with several dogs can seriously reduce the number of birds necessary for breeding stock to recover the winter losses of shooting and other factors. Our figures indicate that coveys may be shot as low as fifty per cent and still recover the population. However, a safe margin is assured when only one-third of the birds are taken, and a take of one-third is advocated in all the subsequent recommendations. Very often hunters are misled even when their intentions are good, since shot over coveys, particularly when shot down to four or five birds, shift to other covey formations equally as low, and leave the impression that large original coveys, unshot, still exist on the range.

All in all, however, the evidence is that the spring population, year after year, is sufficient to restock Oklahoma's quail range in satisfactory numbers and that the hunting take, in spite of both intentional and unintentional overshooting, is not excessive. Around areas of high human population, however, this may not always be true since hunting pressure is sometimes very high.

SOME PROBLEMS OF BOBWHITE STOCKING WITH HATCHERY REARED BIRDS

A problem of no little magnitude confronting the game administration and the sportsmen of Oklahoma is concerned with the functions of a state owned quail hatchery. It is important that the justified functions of such an institution be fully defined and that subsequent operations follow recommenda-

tions of a planned program. It appears that very little thought has been given this phase of game management in Oklahoma in the past.

Obviously the one function of a quail hatchery is directly or indirectly to increase the hunter-take of birds for the state as a whole, while keeping within a cost range, either by low per bird cost of production, or by a high per cent of establishment and increase, whereby the total expenditure is justified. There has been a decided tendency on the part of all concerned to look on large total bird production as the paramount issue. Little, if any, effort has been expended in examination of the results of releases, at least until 1940. Even to date such investigations are so meager as to make definite conclusions difficult.

Even with those interested in the results of bobwhite quail stocking methods, there has been a tendency toward misunderstanding of the basic problem involved. Recommendations are too common regarding conditioning the birds for release, or concerning the best age at which releases should be made, and the percentage of sexes for best survival and increase. These problems are at best only secondary in importance in that they assume that the per cent of survival is the important problem of quail stocking.

It must be understood that survival of hatchery released birds does in no way insure an increase in the total population of quail. Investigation needed is that which would determine the effect hatchery release of birds has toward increasing the total population or, in other words, exactly what does the hatchery contribute toward a higher take for the hunter?

authors have no record of bobwhite ever occurring here in any important numbers. Here, as unjustified release, is represented 2.3 per cent of the refuge area and 1.9 per cent of the released stock.

Restocking, as in Column D, was classified as unjustified because of land use practices. Much of this area once supported excellent bobwhite populations, but extensive cultivation to wheat, extremely heavy grazing and other intensive cropping practices have so reduced the cover and food conditions that quail are no longer found there. Too, high land values in connection with the necessary crop practices, make any habitat improvement procedure extremely uneconomical. Here is represented 13.2 per cent of the refuge acreage and 10.9 per cent of the released stock.

Insofar as our present information is concerned, we are forced to assume that population lows under good habitat conditions, which are due to causes not regular in occurrence, may be aided in recovery by release of hatchery stock. Classified here in this category are shot-out areas close to centers of high human population, areas which have experienced severe local hailstorms, winter storms and floods, providing these are not regular in occurrence. Over-shooting, however, is a factor which must be controlled, and the lows from which cannot be economically aided by release of hatchery stock year after year. In this classification is represented 7.7 per cent of the refuge acreage and 10.9 per cent of the released stock.

In some instances landowners and operators were willing to moderate their land use practice so as to benefit quail populations, providing releases were made or promised. Where these occur as isolated islands of quail habitat, release is justified, and possibly, too, is the thought that quail releases may be justified as a means of encouraging habitat improvement in any case. In this column is included 5.4 per cent of the refuge acreage and 4.4 per cent of the released stock.

SUMMARY OF FINDINGS AND CONCLUSIONS

From these data it is seen that a problem of some difficulty is presented to one selecting refuge areas. Briefly one is expected to select an area lacking sufficient breeding stock to bring its fall population to the capacity of its limits. Generally this amounts to finding such areas as have good quail

food and cover conditions, but which have a low population. To one who understands quail habitat, this is seen to be very difficult throughout the better quail range of Oklahoma. It can be seen on the basis of these data that releases of this nature appear to be extremely questionable in value. However, the poor selection has resulted mainly in the lack of a coordinated program on the part of the game department, in which authority is designated and properly understood. Efficient handling of the release of this stock is a problem aside from the probable value of the stock in increasing the shooting population, and if restocking by hatchery stock is to be continued by the department, it should be carefully examined and brought under the supervision of one person, from the selection of refuges through to the release of the stock in their correct densities.

If these figures in the final analysis are even partially indicative of the condition existing for the whole state, and we have reason to believe that the per cent of unjustified releases would be increased with the inclusion of eastern Oklahoma, then a waste of some magnitude is taking place. This table shows for western Oklahoma that 87.1 per cent of the refuge acreage and 84.6 per cent of the released stock may be classified as unjustified as compared to 12.9 per cent of the refuge acreage and 15.4 per cent of the released stock being justified.

If we were to include eastern Oklahoma conditions in this treatment, it seems that the proportion of unjustified restocking would be even greater, since lows in quail population brought about by factors which can be overcome by stocking do not operate nearly so importantly there as in western Oklahoma.

COMPARISON OF POPULATIONS ON REFUGE-STOCKED AREAS WITH POPULATIONS ON HUNTED-NON-STOCKED AREAS

Table VI presents data in condensed form which were collected from 1940 through 1941, in an attempt to show comparisons of population trends of bobwhite quail on stocked refuges and hunted nonstocked areas. Refuges and checks were of similar environmental nature insofar as the workers were able to determine. A total of 14,991 acres were censused in this work with bird dogs in the early fall of 1940, the spring of 1941 and again in the fall of 1941. Fall counts were made as near before the opening day of

hunting as possible and a spring count made after all danger of loss from what might be termed "winter loss", yet before the coveys had broken up for breeding.

Unfortunately these areas were not censused prior to the time of the first release of birds on the refuge areas. This would have allowed for a much simpler treatment.

Following through, we see that a loss of 16.0 per cent occurred from the time of release to the fall census on the refuge areas in 1940. For the same period and same areas in 1941 the loss was 15.9 per cent, which strongly substantiates further calculations based on these figures. Since the only known population figure available for the period during which the birds released is the number of hatchery birds released, we must assume that the actual loss during this period was much greater and that the compensation derived from the unknown number of wild stock present in the area at time of release would allow for us to conclude that a greater proportion of hatchery stock actually failed to survive. Nevertheless the approximate 10 per cent loss from time of release in July to fall counts in September and October, is significant.

Of particular significance here is the close correlation of winter losses between the refuges and shot-over areas. The total refuge loss which may be termed winter loss was 767 or 54.0 per cent of the fall population, while the loss under similar conditions during the same period on the hunted areas was 54.4 per cent of fall populations,

a difference of approximately one-half of one per cent greater loss on the hunted areas. It is seen here that winter losses remain practically the same whether restocked and protected from hunting or whether hunted. This suggests that neither stocking nor protection from hunting are effective means of quail increase. However, it must be remembered that this is the statewide picture and that localized studies would most certainly reveal areas of population lows caused by overshooting or other factors of irregular occurrence which may benefit by stocking, providing they are of sufficient size to rule out stocking by wild stock through natural spring shifting. Of further importance is the suggestion of these figures that the hunting take is not excessive and does not decrease the breeding reserve under normal conditions.

In recovering the winter loss the fall populations of 1941 on the refuge areas showed an increase of 30.4 per cent over the spring breeding populations. This amounts to a reproductive survival of 2.8 fall birds for each probable breeding pair. Similarly the shot-over nonstocked areas showed a fall increase of 37.7 per cent of the 1941 breeding population or what amounted to a reproductive survival of 3.1 fall birds for each probable spring pair.

From these data we are unable to see that the release of hatchery stock effects more than a temporary influence on population levels on average refuge conditions. The level of populations soon after release flattens out to assume its normal trend despite

TABLE VI
COMPARISON OF POPULATIONS:
REFUGES—STOCKED WITH HUNTED—UNSTOCKED AREAS

Total Acres Censused	No. Birds—1940 Summer Releases	No. Birds—1940 Fall Census	1941 Spring Census	1941—Summer Releases	1941—Fall Census
7953 Refuges Stocked	1692	1420	*653	1860	1590
		272 loss 16%	767 loss 54.0%		270 loss 15.9%
Approximately 8,000 Hunted- Unstocked	0	1790	*815	0	2103
			976 loss 54.4%		

*653 - - - - - 1590

Gain of 937 birds on refuge stocked areas from 1941 spring to 1941 fall
Each spring pair produced 2.8 fall birds.

**815 - - - - - 2103

Gain of 1288 birds on hunted areas from 1941 spring to 1941 fall
Each spring pair produced 3.1 fall birds.

Refuge—Fall 1940 to fall 1941.....Gain of 11.9 percent (170 birds)
Checks—Fall 1940 to fall 1941.....Gain of 17.4 percent (313 birds)

SHOWING POPULATION TRENDS & COMPARISON ON
RESTOCKED AREAS & HUNTED-NON RESTOCKED AREAS

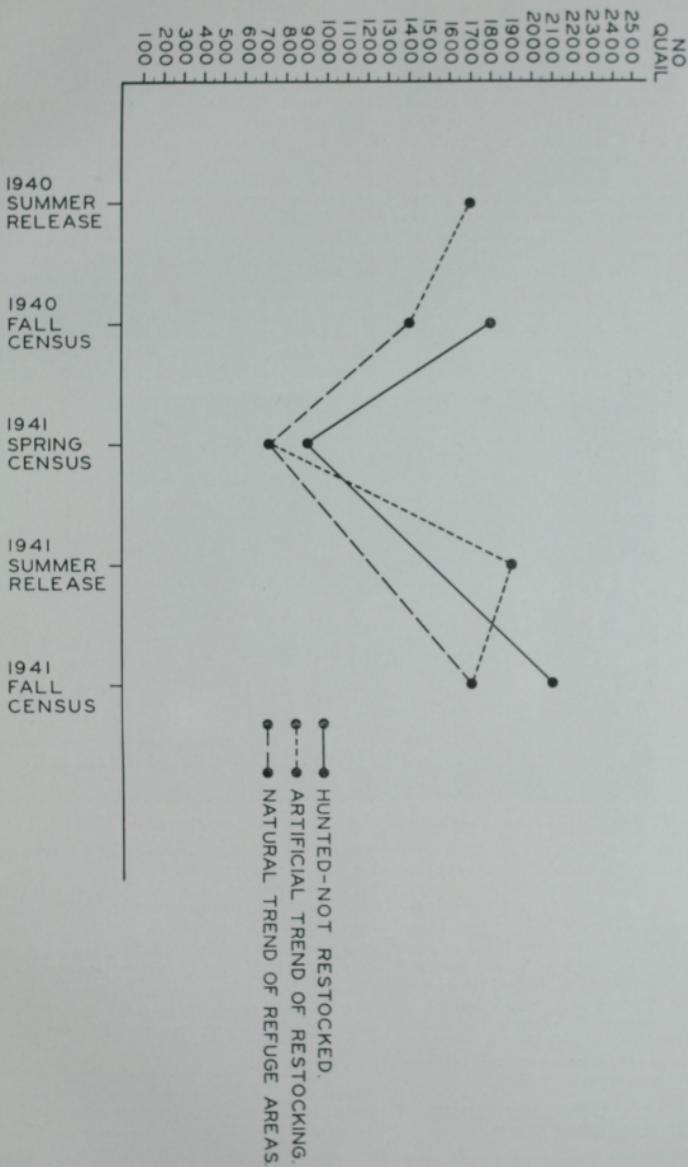


CHART I

the liberation of hatchery birds. By lumping total figures from both refuge and hunted areas the graph following this discussion has been designed. Here it is seen that stocking creates only a temporary and artificial trend which tends to recover rapidly from the disturbance of stocking to reach that same trend effected by the same factors controlling the hunting-nonstocked areas. These factors are believed to be conditions of habitat acting in relation to climatic severity. It is seen then that quail populations are fixed at any particular time at a point depending upon conditions of environment at critical periods in the life history of the bird, and the release of additional stock does not alter the capacity of the range to support more birds and is an effective means of increase

Crawford pasture, bird movement has been followed by banding and trapping, netting, observations and from band returns by hunters outside of the refuge. Although far from complete, some concrete data are available from these sources and show that movement is immediate and often of considerable extent. In fact, if anything is indicated, it appears that there is relatively little tendency to maintain covey formation, particularly during the first few days after release. Not only is this shown by the decided shifting of individual birds, but it was common during the study to find singles and groups of 2, 3, 4 and 5 birds scattered over the area for a few days. These birds were very tame and appeared confused. They could be approached to a distance of a few feet in most

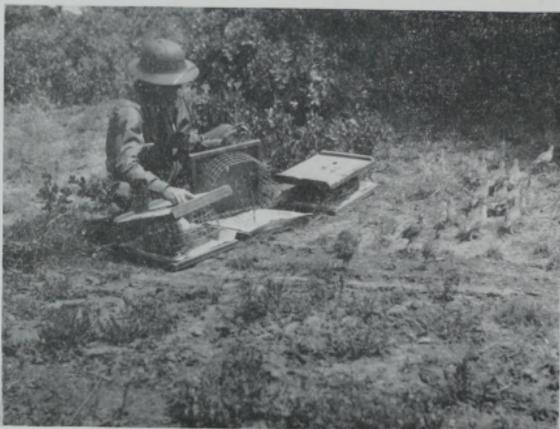


Plate XXXIX—Releasing hatchery reared bobwhites for experimental purposes

only when the breeding reserve necessary to produce capacity populations has been reduced through causes controllable by man.

It appears at present in Oklahoma that with additional research, technicians may forecast fall populations on the basis of periodic censuses, particularly in the eastern half of the state where climate factors are more regular in occurrence and in extent of influence. In western Oklahoma such predictions are much more subject to error since climatic factors are less stable and average years are seldom experienced.

STUDY OF LOCALIZED MOVEMENT OF HATCHERY BIRDS

In an attempt to determine specifically the fate of hatchery reared stock on the

cases. Too, there appeared to be a tendency for the hatchery reared birds to lose a considerable amount of feathers when flushed. Later in the season, however, this feather losing was not noticed.

Of the total of 108 birds released here during the late summer of 1941 33 were recovered by netting about one week after release and by hunters from outside the refuge during November and December of 1941.

Movement toward the outside of the refuge was to generally better quail cover conditions, which supports an average fall density of around 10 to 17 coveys per hunting day. This was considered excellent as unmanaged populations in this section and

BOBWHITE TREND ON
CRAWFORD PASTURE
WOODWARD CO OKLA

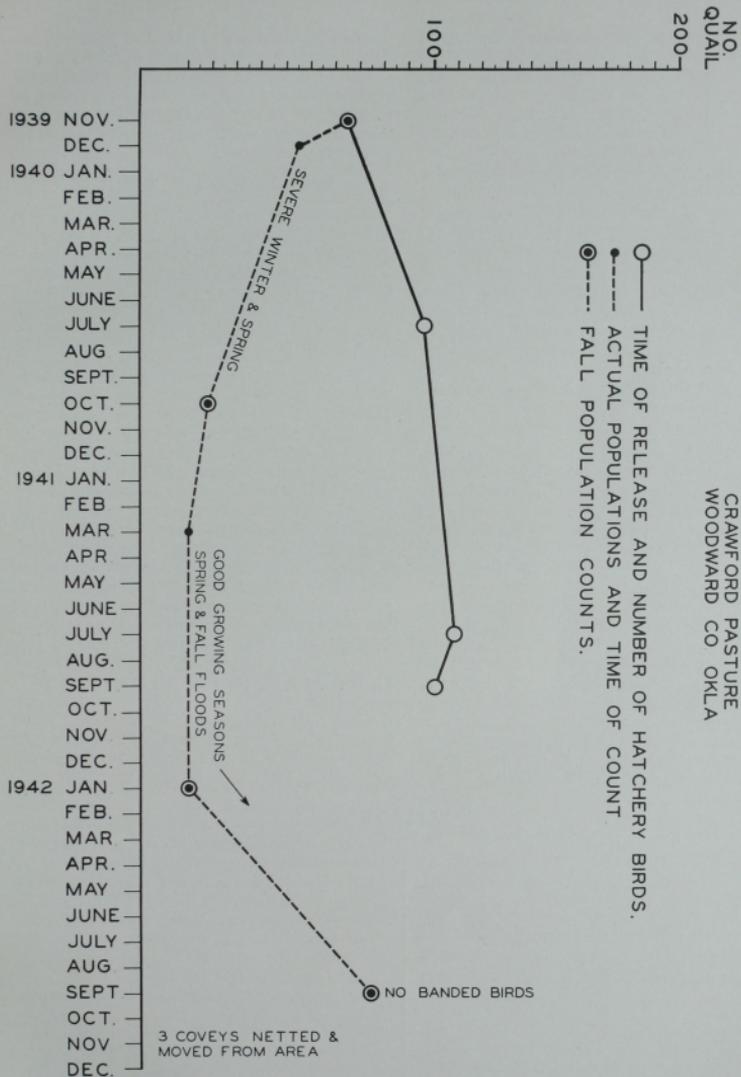


CHART II

it is doubted that the relatively small number of hatchery birds moving out from the refuge materially increased the shooting numbers. It has been our experience that this outside range supports good hunting without any attention. It is, however, subject to the same fluctuations as the Crawford Refuge but maintains them on a higher general level.

There appeared to be no definite pattern as to the reaction of the hatchery reared birds to a population pressure of the wild stock. Through trapping of existing coveys on the study area and surrounding areas, it was found that in some cases entire coveys were composed of one release, while in others birds from two widely separated releases were recovered in one covey, and there is much evidence of hatchery released birds intermingling with wild stock in various proportions.

The accompanying table showing bobwhite trend on Crawford pasture in Woodward county should be of interest to the sportsmen. Briefly, it illustrates an attempt to overcome quail population lows as caused by an unstable environment through stocking with hatchery birds. It is doubted if detailed discussion of the data is worthwhile in view of the clearness of the diagrammed trend. However, it shows that hatchery birds, being subject to the same physiological requirements as wild birds, cannot be expected to supply a bird population to an area suffering from a disturbed environment. Further, when conditions regain normalcy, the decreased wild stock rapidly recovers itself. In view of the wide margin between the capacity of the habitat at the

time of low populations and at time of high population, it seems unlikely that the survival of hatchery birds in any material measure contributed to the recovery. This is largely borne out by the similar recovery throughout this portion of the state where no stocking was done.

BOBWHITE QUAIL WEIGHTS

During the course of the game survey, 537 fall killed bobwhite quail were weighed. The results of these data are shown in Table VII. It is interesting to note that this study bears out the observation of Stoddard (1931) with quail weights in southwestern states. That is, that the birds tend to weigh heavier from south to north.

Birds shot in the vicinity of Mooreland in Woodward county during the seasons of 1939, 1940, 1941 and 1942, from both pastureland and field margins weighed an average of 6.20 ounces. Birds from the vicinity of Stilwell, Adair county, taken from areas of farmland in 1942 weighed an average of 6.0 ounces. In comparison, birds from agricultural sections of Carter county in 1942 weighed only 5.6 ounces, while birds from the forested uplands of McCurtain county in 1942 weighed 5.4. Some further collecting of specimens is necessary to determine if the difference between the Adair county and McCurtain county weights are due to latitude or due to difference in habitat on agricultural and forested areas. It is reasonably suspected that both factors influence weights. Nevertheless, it is seen that birds from the northern section of the state, on the average, outweigh those from the southern portion, which is in keeping with quail

TABLE VII

WILD BIRDS						HATCHERY BIRDS					
Locality	Date	No. Birds	Average Oz. M	Av. Oz. F	Total Av. Wt.	Locality	Date	No. Birds	Average Oz. M	Av. Oz. F	Total Av. Wt.
Woodward Co.	1939	112	5.86	6.43	6.31						
Woodward Co.	1940	84			6.01						
Woodward Co.	1941	212			6.14						
Woodward Co.	1943	33	6.8	6.5	6.7	Woodward Co.	1942	9			5.6
Carter Co.	1942	6	5.7	5.5	5.6	Carter Co.	1942	13	5.7	5.9	5.8
Adair Co. Field Birds	1942	27	6.13	5.83	6.0	Adair Co.	1942	24	5.3	5.5	5.5
McCurtain Co. Timber Birds	1942	16	5.5	5.4	5.4						
Woodward County Wild Birds	6.2					McCurtain County Wild Birds	5.4				
Adair County Wild Birds	6.0					Carter County Wild Birds	5.6				

weight records from as far south as central Texas and Louisiana north to Iowa. It is shown here that hatchery bird weights appear to fall more or less intermediately between average weights for north and for south. We have no information as to the source of the stock of these birds, but there has undoubtedly been much mixing of stock from various areas, since hatchery production began in the state.

SUMMARY

Much of the confusion existing today in the legislative consideration of the administration of bobwhite results from the past failure of the Game and Fish commission to keep adequate scientific records. It is extremely important that the lawmaking body base any laws controlling the taking of this species on statewide studies rather than regional opinions. This accounts for the continued efforts toward a permanent closed season on bobwhite quail. These efforts are sincere in that they assume that bobwhite quail would actually benefit from such a closed season over a given length of time. During the course of the survey the workers gathered considerable information by way of interviews with all classes of people. Almost in all cases those advocating a five-year closed season were not hunters.

It must be emphasized that no one procedure will meet the entire demands of the state's quail problems. Closed seasons, large hatchery productions, refuges, varied shooting days, and bag limits in themselves have little effect in either maintaining or increasing the population if the basic factors are in need of attention. The number one problem is that of suitable habitat. The improvement of this habitat for quail means merely providing a more desirable place for the bird to live. Bobwhite quail have certain definite requirements which have to be met before there is any point in advocating other means of protection or increase. Despite the apparent obviousness of this matter, the experience of the survey workers definitely indicates that, as a whole, habitat problems seldom enter into the sportsmen's or farmers' recommendations toward increasing quail populations, even when food and cover conditions are at such a minimum that it would appear to be the only factor. This is seen to present a problem of first importance in a quail program when it is realized that better than one-third of the applications received by the Game and Fish Commission for hatchery birds come from operators of land absolutely

lacking in the two essentials of quail habitat—food and cover. That is, one-third of the applications received through 1939, 1940 and 1941 were disapproved on this basis alone. This does not take in to account the fact that about 13 per cent of the remaining refuge area was in such a condition of being overgrazed, cleanly cultivated and such, that success could not be expected without some improvement of the habitat.

The bobwhite quail program should be included within a general program of farm game management which would serve to make for a general realization of the value of all farm game species.

Some of the specific techniques by which bobwhite quail may be increased have been experimented with during the survey and are discussed briefly in the following outline. Of course problems vary with the locality, and recommendations must be based on a knowledge of the local limiting factors. Planting of food and cover plants, too, must depend on a knowledge of the soil and weather requirements of individual plant species. However, the following practices have been found to benefit bobwhite quail and are submitted here as general recommendations.

MANAGEMENT TECHNIQUES

A. Regulated Hunting.

This of course is the first most important consideration. Unless studies for particular areas indicate otherwise, not more than one-third should be removed in order not to decrease the breeding stock, leaving at least six birds for protection of the covey on cold nights.

B. Fenced Areas.

Fencing has a definite place in bobwhite management in Oklahoma. However, care must be exercised, since too permanent a fencing program has proven as harmful as no fencing at all.

1. Cleared and fenced areas of woodland may be disked for weed production. These usually need not exceed one acre or one-half acre in size. Cut brush should be piled along the fence line just inside or just outside of the plot. It is usually desirable to include one good thicket within the plot.
2. Fencing blowouts to prevent trampling by cattle and broadcasting grass seed has resulted in the stabilization of ero-



Plate XL—Fencing of a sandhill blowout allowed recovery by vegetation and added another 'covey' to this pasture.

sion hazards in the soil areas of deep sandy soils. This allows a grassy cover to grow up around the thickets normally found in dune areas and furnishes excellent winter cover for quail.

3. On hard lands fencing is absolutely necessary to allow sufficient vegetation to check erosion if the land is pastureland.
4. Most of the farm stream bottoms need fencing at least to prevent trampling

by cattle, which is usually severe and results in choking out vegetation by silting. It appears that most stream bank vegetation is choked out by local cattle trampling rather than cultivation of the drainage uplands. This is one of the principal reasons for this shortage of quail on the mixed and tall grass prairie types.

5. Fenced plots on upland tight soil pastures have not proven too successful.

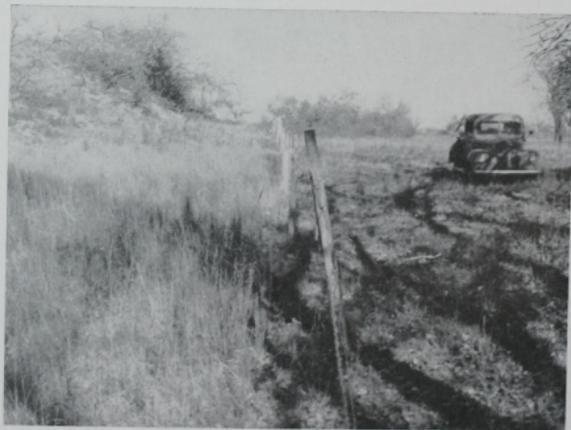


Plate XLI—Showing recovery of poor habitat by fencing out a small area from trampling and grazing by cattle.



3

4

BOBWHITE

- 1 AREA WHERE CLIMATE AND GROUND CONDITIONS
FAVOR THE GROWTH OF BOBWHITE WILDS
- 2 AREA WHERE GENERAL HIGH LAND AND
SLOPING TERRAIN ARE BASIC INFLUENCES
- 3 AREA WHERE LOCAL AND AGRICULTURAL
PRACTICES AFFECT WILDS
- 4 AREA WHERE LOCALIZED AGRICULTURE AND
LUMBERING INFLUENCE POPULATION
- 5 LOCATION OF BOBWHITE CENTRAL AREA
SHOWING DISTRIBUTION OVER STATE

However, there are certain types of conditions where they can be made to work. Too often they allow a pure stand of bluestem grass to grow which does not make for quail habitat. At present no good information is available for establishing coveys permanently on the uplands characteristic of the tall grass prairie in pasture.

C. Food Plots.

Good results in food plant growth was had in Woodward county sandy soils by harrowing and disking. One plot of about one acre in size at the time of this writing is feeding three coveys of bobwhite quail where no birds were ever found before. Food plots in wooded section may be had by cultivating the edges of fields to some perennial seed producing plant, such as some of the lespedezas. Information on food crops adaptable to various soils and portions of the

state may be had from county agents. Generally it has proven that areas of head feed for bobwhite are more expensive than other equally good methods. Too, quail need a variety in their diet which is not to be had from such food plots.

D. Cover Development.

Good results have been obtained by planting wild grapes in thickets lapping over small brushy trees in areas short of cover. Quail even use nets of old wire when other conditions are suitable.

E. Country Roads.

Country roads support a good proportion of the quail population in many areas and could be made so in many other if means were taken to prevent county road workers from burning and mowing such areas.

CHAPTER IV.

THE PRAIRIE GROUSE

INTRODUCTION

Nice (1931) lists four members of the prairie grouse family (Tetraonidae) as formerly a resident of Oklahoma. The Greater Prairie Chicken, according to the records of the Game Survey, was once found throughout the prairie sections of the eastern two-thirds of Oklahoma, overlapping here with the eastern extent of the range of the Lesser Prairie Chicken (*Tympanuchus pallidicinctus*) which occupied most of the western one-third of the state, including the panhandle counties.

The prairie sharp-tailed grouse (*Pedioecetes phasianellus campestris*) is listed in Nice (1931) from specimens and observations from Cimarron county, Oklahoma. It is reported nesting there.

From the same source the Sage hen (*Centrocercus urophasianus*) is recorded by observations south of Waynoka in Woods county, August, 1902, north of Beaver creek in Cimarron county; and from a specimen taken in 1920 it was reported mating and nesting in Cimarron county in 1911 and none seen since 1920. It would appear that these birds are stragglers, since typical Sage hen habitat is nowhere near to Oklahoma.

GREATER PRAIRIE CHICKEN

Tympanuchus cupido americanus

FORMER DISTRIBUTION
AND ABUNDANCE

The greater prairie chicken was formerly an abundant resident of the Tallgrass Prairie Game Type of Oklahoma. It appeared to occupy timbered sections only as a marginal condition to the true prairie, and only came to these areas in the fall to feed on the oak mast.

Early travelers reported seeing prairie chickens throughout the greater prairie chicken range and also in association with the Postock-blackjack Game Type. Latrobe reported immense flocks in the vicinity of farms near Fort Gibson, (November, 1832), Muskogee county. Later (1849) Woodhouse writes that prairie chicken were abundant in the same locality and along the Arkansas river between Fort Smith and Fort Gibson. Cook also reports that they were common

around Caddo (1883) in Bryan county. In 1884 Culbertson mentions that prairie chicken were as common as pigeons near Spiro, LeFlore county.

The first estimate of the greater prairie chicken population was made in 1925-25. Cosman estimated about 3000 birds to be in a refuge in Osage county. The state game ranger made the following estimates: Craig county, 700; Mayes county, 700-800; Nowata county, several bunches; Ottawa county, 1500. Although these estimates were made by guess, they indicate a low population.

Greater prairie chicken populations increased with early settlement. They were found in the entirely timbered areas where large acreages had been closed for farming, but when the country became more thickly settled and agriculture took the place of the natural tall grasses of the prairies and savannah types, the populations began to decrease. This population decrease continued until about 1925 and seemed to remain at a low level for several years, but in the last ten years a slow but definite increase in numbers is noticeable.

PRESENT DISTRIBUTION
AND ABUNDANCE

During the period of March 19 to May 7, 1940, a detailed investigation was made of the greater prairie chicken range by the survey workers. Again during the period of April 1 to April 7, 1941, a check was made on some of the more important booming grounds. The original objective of the investigation was to obtain population figures for all of the counties in eastern Oklahoma supporting prairie chickens, but in the preliminary survey it was found that the bulk of the population was confined to northeastern Oklahoma. Since time was an important factor in the work, the southern counties received but little attention. Census work was conducted in twelve of the northeastern counties, including Craig, Mayes, Muskogee, Nowata, Osage, Ottawa, Pawnee, Payne, Rogers, Tulsa, Wagoner and Washington.

The method used for determining the population was adapted from that of Davison (1940 unpublished) on the Lesser Prairie Chicken in western Oklahoma. It consisted of driving the roads around sample areas and locating all of the booming grounds. The

grounds were then visited and a count made of the cocks. Hens were also counted when they happened to be present.

A total of 36 sample areas were censused during the study which covered 184 square miles of prairie chicken range. Forty-seven grounds were found, upon which 364 male birds were counted. An additional 128 females and 94 of sex undetermined were also counted, which brings the total number of birds seen to 586 or 4.6 per cent of the total estimated population. The average number of males per ground was found to be 8.6 and ranged from 5.3 to 12.7.

The total number of square miles of range in the twelve counties amounted to 4943. Including, in addition, portions of Okmulgee, McIntosh and Delaware counties, there are probably slightly over 5000 square miles in all in this section of the state.

From these samples a male population of 7,599 birds is estimated as compared to a female population of 5,056 or a total of 12,655 in all. It should be emphasized that the female figure is tentative since it was calculated on an arbitrarily established sex ratio of 150 males to 100 females. It is approximately that figured for the Lesser Prairie Chicken by Davison.

The following table presents these figures in tabular form for 1940.

LIMITING FACTORS

As with most other game species of the state, the human use of the land by converting natural prairies to agricultural lands constitutes the greatest limiting factor on greater prairie chicken populations. The potential population under management is limited by the amount of unbroken prairie left in the state. Then here the degree of use in grazing, burning and mowing is of great importance. Other than cultivation which is not controllable due to the general high agricultural value of the prairie soils, such factors as fire, weather, poaching, predators, natural cycle, overgrazing, drouth, disease, parasites, food and cover and land use conditions all contribute to a fluctuating population.

PRAIRIE FIRES

Prairie fires which occur at nesting time are extremely destructive to eggs and young. Unlike the bobwhite quail, this species shows less tendency to reneat after such a disturbance. However, it appears that most burning catches only the early nesters, yet excellent nesting cover is destroyed for subsequent nesting and brooding. Generally over the prairie chicken range there is a growing appreciation of better grassland management, which excludes burning. Despite the general expert opinion against burning, some economic factors appear to encourage

TABLE VIII
SUMMARY OF GREATER PRAIRIE CHICKEN CENSUS DATA BY COUNTIES

County	Sq. Miles Censused	Total Number Grounds	Male Birds Counted	Av. No. Males per Ground	Sq. Mi. of Range	POPULATION		
						M	F	Total
Craig	16	12	106	9.5	170	2009	1339	3348
Mayes	13	7	54	7.7	337	808	538	1346
Muskogee	16				416	42	28	70
Nowata	13	6	32	5.3	500	1017	672	1689
Osage	52	13	93	7.1	1000	1775	1183	2958
Ottawa	4				190	493	328	821
Pawnee	9				301	106	70	176
Payne	12				356	99	66	165
Rogers	13	4	51	12.7	37	724	482	1206
Tulsa	6				150	42	28	70
Wagoner	12	4	20	10.0	270	340	226	566
Washington	18	1	8	8.0	340	144	96	240
Total	184	47	364*	Average 8.6	4943	7599	5056	12,655

*In addition to the 364 male birds counted, there were 128 F and 94 sex undetermined. Total number birds seen—586.

the practice. Farmers report that when the demand for prairie hay is slack, the buyers penalize the growers on new hay in which the previous year's growth is mixed. For this reason alone, many farmers keep up the practice of spring burning.

WEATHER

The character of the weather during the nesting season appears to be a limiting factor which will vary from year to year. Heavy spring rains and cold weather during nesting and brooding is known to seriously reduce the hatch and survival of young birds. The weather is also associated with food and cover supply and birds should come through the winter in good shape to be able to withstand the demands of breeding.



Plate XLII—Prairie fires cause much damage to prairie chicken nests.

POACHING

It is well known that illegal shooting of greater prairie chicken is common in certain sections of northeast Oklahoma. In these areas public sentiment favors such practice on the contention that the chickens in the fall and winter destroy large amounts of feeds. However, even within these areas of most complaint, are many farmers who try to protect the chickens and who resent sportsmen poaching on their lands. After a careful check of farmers' opinions throughout this section, it is believed that sportsmen are more concerned over the destructiveness of prairie chickens to crops than are the farmers themselves.

OVERGRAZING

Overgrazing is an important limiting factor in some areas as it relates to food and cover primarily. Suitable cover for nesting in some areas appears to be important. Although there is a trend toward regulating the number of stock on a given range, there are still extensive areas where overgrazing is the rule.

DROUTH

Even though it was not possible to obtain data on the importance of drouth as a limiting factor, the account from Missouri is worth restating. Large losses of chickens were reported here to have occurred around recently dried water holes in the drouth of

1934, especially on the western prairies almost adjoining Oklahoma. It appeared that the cause of death was the heat and lack of water.

DISEASE AND PARASITES

No data were obtained on the importance of disease and parasites although in some instances these may be worth consideration. There are dangers from infection from domestic chickens of such disease as black-head.

LAND USE

Aside from poaching, land use factors as a group are the most important present day consideration. An understanding of these factors is absolutely essential to proper man-

agement of chickens. In general, it can be stated that most of the prairie chickens are found on or associated with lower grade land as compared to the better farm land in Oklahoma. Consequently most of it is more suitable for grazing than for farming, and there is a gradual tendency toward an increase in hay land, sorghums, and legumes, and a decrease in corn production as the soil has become exhausted. All of these tend to better the environment for prairie chickens. The increase in cultivated acreage in Craig county, for example, has been very small since old land is allowed to revert to prairies about as fast as new land is broken. Statistics show that between 1909 and 1929 there has been an increase in the following crops: sorghums grown from grains, soybeans and legumes. Yet the total hay production has been reduced very little. In addition, there has been a marked decrease in corn production from 1909 to 1929. In Mayes county statistics present an ever more encouraging picture since 1934. These figures show a decided increase in sorghum production, a noticeable increase in both tame and wild hay, and a decrease in corn production. All these trends point toward a general improvement in environment which undoubtedly accounts for the steady recovery of chicken numbers in recent years. It is believed the control of illegal shooting should allow for further illustration of this trend.

MANAGEMENT AND RESTORATION

Unlike the lesser prairie chicken in western Oklahoma, the greater prairie chicken now occupies, in at least small scattered and isolated flocks, almost all the range which is even likely to become habitable for the species. For the most part restoration will be confined to attempts at increasing carrying capacity of land already supporting chickens. Exceptions to this are smaller prairie sections in south central Oklahoma in Comanche, Stephens, Garvin, Murray, Carter, Pontotoc and Johnston counties, to name the larger areas. For these latter sections it will be necessary to trap and transplant prairie chicken stock from northeastern Oklahoma. Too, in event of an open season on chickens in northeastern Oklahoma, this south central range may serve as a guarantee against total depletion for the state. Such a project is under consideration of the Game and Fish Commission at the time of writing.

Increasing populations throughout the occupied range, at least until further re-

search should show otherwise, must depend on more moderate use of the existing grass land, better control of illegal shooting, and continuation of the trend of land use toward reversion of worn out land to pasture.

THE POSSIBILITY OF A FUTURE OPEN SEASON

At the present time no one with the interest of preserving the prairie chicken in Oklahoma in any numbers at all can recommend an open season. The only possible justification would be from the farmer's point of view—that of controlling chicken populations on the basis of crop damage. However, in all fairness, it must be stated, however, that it is known from actual observations that some reports of serious crop damage are exaggerated and it appears more often than not that such exaggerations have their source, not in the farmers themselves, but in sportsmen and others. Some of this results from the impression of huge populations caused by seeing the birds in the winter concentrations at which time birds from vast areas may flock together.

If Oklahoma is to have a greater prairie chicken hunting on a sustained basis, several things must be taken into account. First, it is doubtful if this species can ever support a season of the length and regulation of the bobwhite quail now. Even if it should reach far beyond the most optimistic predictions of its reaction to management, the total potential is too small for such unregulated hunting. It will be necessary to combine greater and lesser prairie chicken hunting dates and limit the take to a relatively few hunters and only two or three birds per hunter per season. However, other states have found it economical to handle a certain species whose range is limited in this manner, and there is no reason why such plan should not be at least considered in Oklahoma. Hunting privileges are often determined in these cases by ballot which allows a few hunters from all sections of the state to participate.

By combining greater prairie chicken management with several other species of game and furbearing animals much can be done to prevent the huge investment of sportsmen's funds in a species offering such limited promise as does the prairie chicken.

Greater prairie chicken management combines easily with a land acquisition program, which, as a long time procedure, eventually provides for public owned shooting

preserves. And since open and free shootings appear very definitely to be gradually leaving the picture, such a program of acquiring land is a desirable activity of state game and fish departments in order that the right to hunt and fish always will be the privilege of all classes of license-buying people.

At present it appears that prairie chicken, as well as all other game and furbearing species, would benefit from the establishment of at least three large refuges in north-eastern Oklahoma on which the game department had sole word as to land use. One in Craig, one in Osage, and one at the junction of Rogers, Mayes and Wagoner counties would be desirable. These may be purchased with Federal Aid to Wildlife Funds and set up to function as public shooting preserves. As nearly submarginal agricultural land as possible would receive first consideration. Worn out crop land may economically be made to produce a game crop. It is only on such controlled land that habitat, over such wide blocks as is necessary to benefit prairie chicken, may be managed.

LESSER PRAIRIE CHICKEN

Tympanuchus pallidicinctus

HISTORICAL NOTES

Although we have considerable historical data at hand, we have not been able to define clearly the conditions which made for boundaries between this species and the greater prairie chicken. There appears to have been considerable overlapping of the ranges of the two species, but considering that conditions which make for suitable habitat for the greater were diminished, moving west, it seems that there should have been some exacting differences in requirements of the species. The same would appear to be true for the lesser species. Early in the work, evidence pointed to separating the ranges of the two species on basis of soils. Our records show that the greater occupies the tall grass prairies of the tight soils, while the lesser is found on the loose sandy soils supporting a sagebrush or shinnery oak vegetation. This may have been true in the central part of the state formerly, but throughout the western counties, records show that the lesser prairie chicken was just as abundant, if not more so, on the eroded mixed grass tight lands as on the sandy land. However, since the sandy land, even under heavy grazing pressure, continues to sup-

port a brush vegetation, the chickens have been able to maintain themselves here.

FORMER DISTRIBUTION

With some thirty literature references to prairie chickens in western Oklahoma, extending from 1792 until 1931, and from interviews of a great many "old timers", we have constructed the accompanying map which shows the approximate former distribution of the lesser prairie chicken and that area or region in which the greater overlapped into the range of the lesser.

Certain historical references indicate that this western occurrence of the greater species was due to the movement of agriculture. However, records show that they were found at least as far west as the marked eastern limits of the lesser prairie chicken. In the vicinity of Canton in Blaine county an early settler tells us of there being two kinds of prairie chicken in early days before settlement. He describes them as the "booming and cooing kind" and the "gobbling kind". Further he says that the booming chickens were found on the uplands while the gobbling ones were found on the sand hills and often called "sandhill" chickens.

From all evidence we have, it appears that the lesser prairie chicken was found generally over western Oklahoma but within the high plains or shortgrass plains they were more or less confined to the sandy stream courses of Quarternary deposits on the north sides of the water courses. Here, cover consisted of heavier vegetation such as shinnery oak or sand-sage.

DECLINE AND HUMAN OCCUPATIONS

Examination of the literature of this species shows that people did not become alarmed concerning the decreasing numbers until about 1909. Recommendations at this time were made by men prominent in game conservation. Dr. Hornaday and Theodore Roosevelt were among those who made statements regarding the condition of prairie chicken in Oklahoma. In 1909 Dr. Hornaday recommended that Oklahoma protect the lesser prairie chicken for a period of ten years. F. S. Barde, a contemporary, and probably better acquainted with the situation, said that a five year closed season would have been better at this time.

From 1895 to 1909 prairie chicken could be shot between August 1 and December 31, with no mention of the number of birds allowed per hunter. This law was passed by

the Territorial Legislature. Statehood came in 1907, and the State Sportsmen's Association and the State Game and Fish Protective Association, with the help of the U. S. Department of Agriculture and the National Audubon Society, presented the Governor and the Legislature in 1909 with a draft for a general fish and game law. A season for taking prairie chicken was fixed as follows: Hunting permitted only from September 1 to November 1 (Sec. 2, Art. 11, Chapt. 19, Session Laws of Oklahoma, 1909). A daily bag limit of 15, or 100 per season, was also provided. This law remained in effect until 1915 when the legislature passed a law prohibiting the hunting of prairie chicken at any time. (Sec. 2, Chapt. 185, Session Laws of 1915).

In 1929 the legislature provided a law (Sec 4834, Oklahoma Statutes 1931) which gave the game and fish commission power to declare open seasons on deer, wild turkey, or prairie chicken when and if such game became so numerous in any county or counties as to endanger private property or farm crops.

With this authority the game and fish commission, in June, 1929, declared an open season on prairie chicken as follows:

"It appearing to the State Game and Fish Commission of Oklahoma that prairie chicken have become numerous in Ellis, Roger Mills and Beckham counties, and that part of Harper county west of State Highway No. 14 to the Harper county line and south of Highway 11, as to endanger and damage crops; that the proper season for shooting such game is required by Section 5, H. B. 261;

"It is therefore ordered by the State Game and Fish Commission of Oklahoma that an open season for shooting of prairie chicken is declared in the above described territory beginning at 6:00 A. M. of the 13th day of September, 1929. That during said period resident hunters possessing hunting licenses may hunt prairie chickens and kill not exceeding six (6) per day, and such hunters shall not have in their possession at any time more than twelve (12) prairie chickens."

Concerning the above declared open season, the Oklahoma Game and Fish departmental Bulletin made this brief comment in its September, 1929 edition:

"Everyone visited the chicken country in chicken season but Chairman Har-

ris. Roads were muddy, rain during the early part of the pilgrimage, weather was cool, coats needed, grub scarce, sleeping places scarcer, profanity the common expressive diction, few chickens killed, everyone undergoing unusual hardships—yet everyone reports a good time."

Two years later, in 1931, another open season was declared in prairie chicken. This was a three-day season, on September 15, 16 and 17, 1931, in Beckham, Roger Mills, Harper and Beaver counties, and that part of Woodward county lying west of State Highway No. 33, and that part of Ellis county lying north of Federal Highway No. 60. The bag limit was fixed at five per day and only residents of the state permitted to hunt, as in the 1929 season.

In commenting on the 1931 season the Departmental Bulletin had this to say:

The open season on prairie chickens was all that was anticipated. A check-up shows that there were not nearly as many hunters who took advantage of the open season as in 1929 when the season was last opened, also that those who did go out this year were not disappointed, as the chickens were plentiful. Very few complaints came into the office concerning depredations to farm property, and all in all, the departmental executives and rangers were proud of the fine sportsmanship displayed by Oklahoma citizens who enjoyed the three-day open season."

The last open season on prairie chicken was in 1933, when a three-day season was declared for October 2, 3 and 4, 1933, in the counties of Beckham, Roger Mills, Ellis, Woodward, Harper, Beaver and that part of Texas county south and east of State Highway No. 54. Resident hunters only were allowed to hunt, and permitted to take not more than five per day, nor more than ten during the season. No comment from the state game and fish department is available for this season. However, Davison (1940) had this to say:

"An open season adjacent to the study area in the fall of 1933 was followed by a great decrease in numbers within the area."

The above statement is based on interpretation of the census figures from sixteen square miles of the Davison Ranch in Ellis county.

It is doubtful if the closed and open seasons and their resulting influence was clearly appreciated by the game interested people of the state. It should be clearly pointed out that a closed season will not always cancel that factor or group of factors which affected the decrease. An investigation of the land development of western Oklahoma leads us to believe that at the time the closed seasons were legislated, they possibly had no effect whatsoever in turning the downward trend of lesser chicken populations. In fact, historical information indicates that the closed seasons came after the chicken had already suffered such a decrease in habitat as well as in population that the protection from shooting did very little to bring back the chickens.

A tremendous change in prairie chicken habitat and environment occurred between 1900 and 1910. Furthering this effect was World War I which placed practically all land into cultivation that was flat enough to be tilled. Another influence, probably secondary in importance, but first chronologically, was the establishment of permanent cattle ranches in the area, which started about 1870.

At one time practically every quarter section of prairie chicken range in western Oklahoma supported a family, even if for only a few months. Many of these people, particularly on the poorer soils, left the country shortly after the land opened, but the greatest movement has occurred during the depression post war period and during the drouth years. From 1930 to 1940 over 70,000

people left this area. Much of this land is returning to grassland, and unless some unpredictable change occurs in the governmental land use policy, we can expect a gradual change to grassland economy to develop here, with, of course a return of lesser prairie chicken numbers. This is happening now in certain areas where soil conservation districts are active.

The decreasing chicken supply fairly well correlates with the periods of human influx and farm land development. However, the mere examination of the land itself will clearly show that the chickens' absence over the majority of the former range may be explained by the fact that the conditions which largely supported chickens are no longer there. Further, under the present economic conditions, there is no reason and no hope for attempting restoration over most of this land. Its value as a crop producer will not permit the drastic change necessary for maintaining chicken populations. Our interest in chicken restoration must be concerned with that land unfit for cultivation, and which can be economically returned to grass land for cattle raising and for game. Fortunately, under moderate and intelligent grazing use, most of this poor land will support good chicken numbers.

PRESENT POPULATION AND DISTRIBUTION

This species lends itself well to census techniques. Davison (1940) describes the habits of cocks in gathering on "gobbling" grounds from March until early June, for the

TABLE IX
SHOWING LAND USE COMPOSITION OF CENSUS PLOTS

Plot Number	Pasture Shinnery or Sage (Acres)	Old Fields (Acres)	Land in Cultivation (Acres)
1	1,807	513	240
2	1,829	198	533
3	2,328	0	232
4	2,353	207	0
5	2,450	40	70
6	1,745	678	137
7	1,548	140	872
8	2,348	92	120
9	2,392	80	88
10	2,395	75	90
Totals	21,195	2,382	2,023
Pasture		82.7 percent	
Cultivation		9.3	
Oil Fields		7.9	

courting and mating activities. Individual cocks appear to use the same grounds throughout the season and probably from season to season throughout the life of the cock. These grounds are easy to locate and fairly easy to count, and hence give a fairly easy method of census in comparison of methods used on other species. Knowing the sex ratio it is possible to get fairly accurate population trends for large areas by a sampling method. We have found this method extremely valuable for our work of the wildlife survey. Insofar as we have been able to determine, there appears to be fewer variables involved in this method than with other methods with which we have had experience. The only factors influencing the accuracy of calculation of total populations appears to be the sex ratio. According to Davison's figures (1940) there seems to be some variation in sex proportions from year to year, and in sufficient degree as to make the knowing of this factor necessary for calculations of this sort. Davison's figures were determined from the examination of young birds and are likely to show a change during the breeding season. Too, as with

all sampling census techniques, there is the important problem of correct application of the figures, or interpretation of the habitat.

PROCEDURE OF CENSUS

The first step in the census was to establish the extent of occupied lesser prairie chicken range. This was done through interviews with local game rangers, farmers, ranchers and sportsmen. Along with this, a game cover type map was prepared which, of course, simplified determination of the range considerably.

Ten sample census plots were selected, consisting of four square miles each. It is believed that a larger plot would have made the samples more indicative of the actual populations, but wider variety of habitat conditions were available for sampling this way. In future work it is recommended that plots of sixteen sections be used.

During the spring census in 1940 the selected plots were visited on the afternoon before each census and after information from aerial photo sheets and other sources were placed on a map. Gobbling grounds

TABLE X
THE LESSER PRAIRIE CHICKEN POPULATION IN OKLAHOMA

COUNTY	CAPACITY POPULATIONS			EVENLY DISTRIBUTED BUT BELOW CAPACITY			Potential Range Scattered Flocks		TOTALS	
	Square Miles	* Density	Populations	Square Miles	* Density	Populations	Square Miles	Populations	Total Range	Ttl. Populations
Ellis	99	36	3,564	239	14	3,346	332	590	670	7,500
Roger Mills	59	24	1,416	384	3	1,152	87	0	530	2,568
Woodward	0	0	0	198	10	1,980	285	500	577	2,950
Woodward	0	0	0	94	5	470				
Harper	0	0	0	171	5	855	105	0	276	855
Beaver	0	0	0	59	5	295	637	150	696	445
Beckham	0	0	0	76	3	228	202	0	278	228
Texas	0	0	0	0	0	0	128	0	128	0
Dewey	0	0	0	12	14	168	105	100	117	268
Alfalfa	0	0	0	0	0	0	114	0	114	0
Grant	0	0	0	0	0	0	13	0	13	0
Gimarron	0	0	0	0	0	0	385	50	385	50
Woods	0	0	0	0	0	0	178	50	178	50
Harmon	0	0	0	0	0	0	69	0	69	0
Jackson	0	0	0	0	0	0	70	0	70	0
Greer	0	0	0	0	0	0	80	0	80	0
Major	0	0	0	0	0	0	30	0	30	0
	158	31	4,980	1,233	6	8,494	2,820	1,440	4,211	14,914

Perc. Area 3.7 Perc. Area 29.2 Perc. Area 66.9
 Perc. Birds 33.3 Perc. Birds 56.9 Perc. Birds 9.6 Av. Density 3.5
 Density 31 Density 6 Density 0.5

* Birds per square mile.

were often located at this time, as well as tracks, droppings and other signs.

On the morning of the count the workers arrived on the plot to be checked before sunrise and, as the first sound of gobbling, began driving parallel trips across the plot on each section, depending on the presence of fences. Each ground was accurately placed on a map and the number of cocks counted. Grounds were visited on an average of three times each and observations made with the aid of twenty-power binoculars, which made cocks and hens easily distinguishable. All counts were made from a car, which permitted close examination of the grounds. Notes were kept separately by the two workers and compared at the end of the morning count.

When the results from all of the census plots was at hand the data was projected throughout the entire chicken range for the conditions which the samples represented, and populations calculated. This information is summarized in Table No. X and both present occupied and potential range is listed. The accompanying map diagrammatically expresses this same information. Examination of this map shows that 36.8 per cent of the prairie chicken population is inhabiting 10.6 per cent of the total range. This does not include the Davison Ranch area which occupies only 2.3 per cent of the chicken range and supports 23.2 of the population.

MISCELLANEOUS INFORMATION ON GOBBLING GROUNDS

No specific attempt was made to determine gobbling ground requirements of these birds, but some information was accumulated which may be of value. Almost always the cocks of the lesser prairie chicken were found gobbling either on the sparsely vegetated top of low flat and rolling hills or on the broad sides of more pronounced terrain. Hills covered with tall shinnery were not used. Preference was shown to open grass land.

From twenty-six grounds for which data are available, we find that the average distance from water was 0.7 of a mile. From farm dwellings it was 1.3 miles and from cultivated fields it was .95 miles. This indicates that the chicken may be somewhat more tolerant of human presence than is commonly believed, at least regarding gobbling grounds. However, we have no records of this species using gobbling grounds after cultivation, as has been reported for

the greater species in northeastern Oklahoma.

Practically all of the open water referred to above is that found in the large circular metal water tanks in pastures. These mills are usually left running and large pools form around the tanks. The overflow is often of sufficient stability as to establish various stages of hydrophytic succession.

In 1933 and 1934 around 400 lesser prairie chicken were netted in Ellis county and moved to other parts of the state. In most cases these birds were liberated in what is considered to be typical greater chicken habitat. In addition, little of the range was in a condition to support chickens in any numbers. The majority of these releases were checked and no evidence found that pointed to survival except upon two areas in western Oklahoma in former lesser range where establishments were made.

LIMITING FACTORS

Already discussed in this report is the influence of human settlement on the lesser prairie chicken habitat. Excessive land use is such a common practice in western Oklahoma and such a variable one that securing of adequate data regarding various degrees of usage is very difficult and involves years of study. On the whole, we believe that the changes in environment due to settlement have created the principal limiting factor. All other important causes of loss discussed below have been greatly influenced by the reduction of food and cover brought about by overgrazing, burning and cultivation.

PREDATION

Only incidental observations were made on predation. Of the damage done by hawks, two species seem primarily responsible. These are the Cooper's hawk and the prairie sharp-skinned hawk. These two species are fast of wing and capable of catching either prairie chicken or quail. It appears that either of these hawks could cause serious losses on coveys of prairie chicken, enough in fact to possibly warrant control locally.

Many time marsh hawks have been observed flying over the gobbling grounds. The birds were flush at once and return shortly, often before the hawk had left the vicinity. At no time has this hawk, or any of the related larger hawks, been observed

attempting to catch a cock on the gobbling grounds.

Crows and ravens are numerous in the lesser prairie chicken range and may do enough damage to warrant control measures. Davison reports the finding of prairie chicken egg remains in the stomachs of three young birds, either crows or ravens. During 1935 when cover was poor, Davison also listed the destruction of many nests by crows or ravens. He suggests location of the nests and then destruction, systematically, of the young and adults, if possible, during the following nesting season.

Coyotes have several times been observed passing a gobbling ground in the early morning without paying any attention to the gobbling cocks, and the cocks likewise gave no heed to the coyotes. Coyotes are very numerous in this region and bear watching as to depredation they may cause during the nesting season. Poultry raisers in this vicinity often lose as much as fifty per cent of their flocks from coyote depredations.

Some snakes are of such abundance as to be important as a predator in destruction of eggs and newly hatched chicks. The bullsnake is particularly common and has, on several occasions, been found to contain in its stomach the remains of young quail and prairie chicken.

Other suspected predators of prairie chicken nests and young are the opossum, skunk and terrapin. Various species of rodents, such as ground squirrel, pack rats, and kangaroo rats, may in some cases be classed as actual predators, but in most cases, are considered as competitors in the prairie chicken habitat.

WEATHER

Drouth has a decided influence in prairie chicken populations by causing a reduction of food and cover. We have no records of addled eggs due to lack of moisture or high temperature, and doubt the importance of loss to this cause.

Heavy summer rains can possibly cause losses among the young birds. The heaviest rains since settlement occurred during the summer of 1941, and many hens were reported to be seen without young, when ordinarily young are usually observed.

BURNING

The use of fire in game management is coming to be recognized as beneficial when

controlled. Under light grazing pressure in the chicken territory, burning is undoubtedly of value in the development of game foods, but such a small proportion of this land is moderately used that the use of fire should be discouraged entirely until better land use is practiced. Burning has always been practiced in this region to destroy the old grass, letting the new spring growth be made more readily available for the cattle and also to stop the budding of the shinnery oak species. These buds are reported as being poisonous to cattle. Recent recommendations in range use here favor removing the cattle from shinnery pastures, during the budding season, which results in better grass growth. Also very few of the pastures can stand burning at any time. Davison recommends that burning be delayed until April 10, so as not to interfere with prairie chicken nesting.

ILLEGAL SHOOTING

The extent of illegal shooting is not well known, but there is evidence to indicate that the take from this source may be considerable. Probably the greatest loss occurs during the quail hunting season. Game rangers are unable to patrol the large areas of country here, where there are few roads. Farmers encourage shooting of the prairie chicken in many localities. In fact, some require hunters to shoot the prairie chicken to pay for the quail shooting rights. This is because of the supposed damage the chickens do to the shocked head-feed in the field.

OTHER MORTALITY

Davison says that the greatest loss of birds occurs during the first few weeks of the life of the young birds, which we believe is true regarding all ground nesting birds in this area. There is little evidence to indicate the cause of the loss. However, it might be due to weather, predators or poor range conditions. In any event, under the present cover and food conditions, the loss is probably a natural one and will not be eliminated until better environmental conditions are supplied for the prairie chickens.

We believe that, providing sufficient effort is made and proper cooperation of land use agencies obtained, the lesser prairie chicken can be made to occupy a place in the game picture of western Oklahoma. This statement is made in the face of much difference of opinion as far as the sportsman is concerned.

The program of restoration of this species is coupled with research, education and administration. The first of these—research—should include not only investigation into the life history, requirements and limiting factors of the prairie chicken, but should also check into the means and methods of administering the results of the research on the chicken. It should include studies on disease, predation, requirements of food and cover at all life stages, daily and seasonal limits of movement, effects of grazing and burning on nests, young and adults, and establishment of satisfactory methods of census for various seasons of the year.

Without education of the public, and particularly the landowner who is in daily contact with the prairie chicken on his prop-

All of these requisites for the restoration of lesser prairie chicken were embodied in the program of transplantation and investigation submitted as a Pittman-Robertson project initiated July 1, 1942.

RECOMMENDATIONS

Basic recommendations for the lesser prairie chicken are similar to those made for the greater prairie chicken. They entail research, transplantation and large area refuge management. Needless to say, some progress has already been made toward restocking areas of recovered grass lands by trapping the stock from the areas of capacity populations.

Moderate grass land use outside of lands operated for game production by the state



Plate XLIII—Lesser prairie chicken nest—Ellis county.

erty, there can be little hope for the recovery for this species in Oklahoma. This education must include the showing to the landowner the value of the prairie chicken to him. There is at hand sufficient information to enable us to start immediately some transplanting of the species from areas of abundance to areas of scarcity. Although this may not result in an immediate pronounced increase in population, it will be invaluable to aiding the natural recovery of the birds throughout their prospective range, and being a program of definite action, will be more tangible and easily understood by the average critical sportsman. This procedure will serve as education for the sportsman.

deserves even more emphasis throughout the lesser chicken range than that of the greater. Most of the soils here are light sandy soils subject to severe wind erosion when the protective vegetation covering is removed. Fortunately, larger ranch holders within the lesser prairie chicken range are improving their grazing methods and a considerable amount of range has shown excellent recovery since 1939. Too, land use is progressing gradually toward larger holdings, all of which benefits the prairie chicken.

MISCELLANEOUS INFORMATION ON PRAIRIE CHICKEN RESTORATION

Information on restocking habitat formerly occupied by prairie chicken, or on stock-



Plate XLIV—Field workers building prairie chicken net used in transplanting of stock.

ing areas outside their natural range, shows the following:

Either greater or lesser chicken, when introduced outside their former range, are not likely to become established. During 1933 and 1934, some 400 lesser prairie chicken were moved from Ellis county to former range of the greater prairie chicken in eastern Oklahoma. Subsequent investigation showed not one instance of survival or establishment.

Better results have been had when stocking within natural range, when plantings

are made in lots of fifty or more. Mortality is normally high in this type of work and larger releases insure a greater number of birds to survive.

Techniques, based on Davison's methods, have been worked out permitting trapping of upwards of 200 to 300 lesser prairie chicken a season. However, trapping methods for capturing large numbers of greater prairie chicken have not worked out and there is need of research here.

To date, prairie chickens have not been successfully reared under hatchery methods.



Plate XLV—Setting up net for capture of prairie chicken.

Information is needed on the chemistry of their natural food so these requirements may be duplicated in commercial foods.

Successful stocking with lesser prairie chicken resulted from the work of 1942 and 1943. Some 200 birds were trapped during the summer in Ellis county and released in regions formerly occupied by this species. Recovery of the grass lands from drouth influence permitted a good survival and establishment of this stock in Cimarron, Harper and Woods counties.

more intensive, greater detail is allowed in the treatment with this species. If the present trend of reverting old broken land to grass land pastures continues, western Oklahoma can support around 72,000 birds in the future. A safe hunting take would allow for around 24,000 birds a season on this basis. The greater prairie chicken population for which relative conclusive information is not available, should, with management, come to occupy its northeastern range at an average density of 10 birds per square mile. This



Plate XLVI—Locating prairie chicken broods for netting.

FUTURE FOR PRAIRIE CHICKEN IN OKLAHOMA

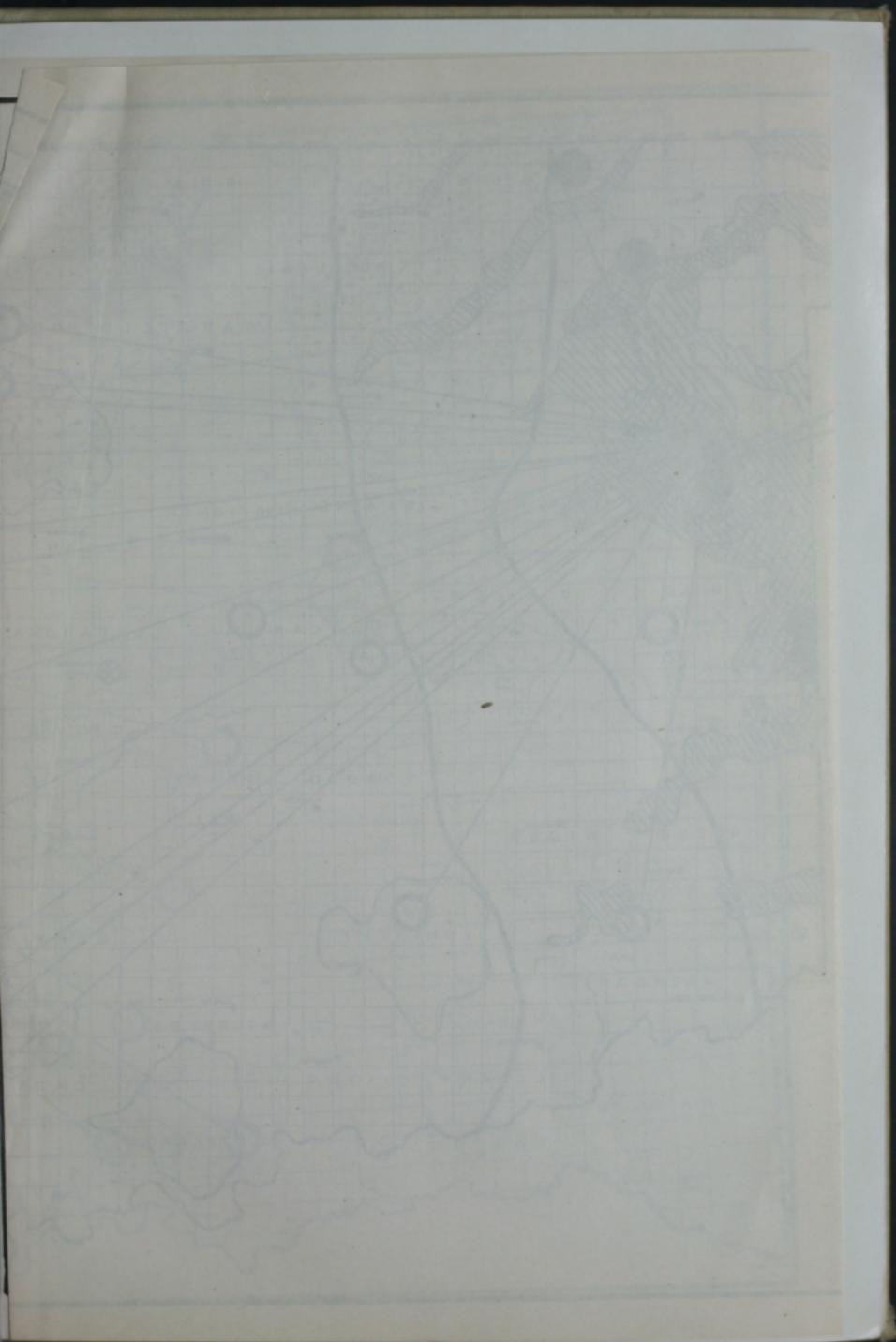
It is not expected that future investigations will permit the same restorations treatment of both species of prairie chicken in Oklahoma. However, it is convenient to consider them together as game species.

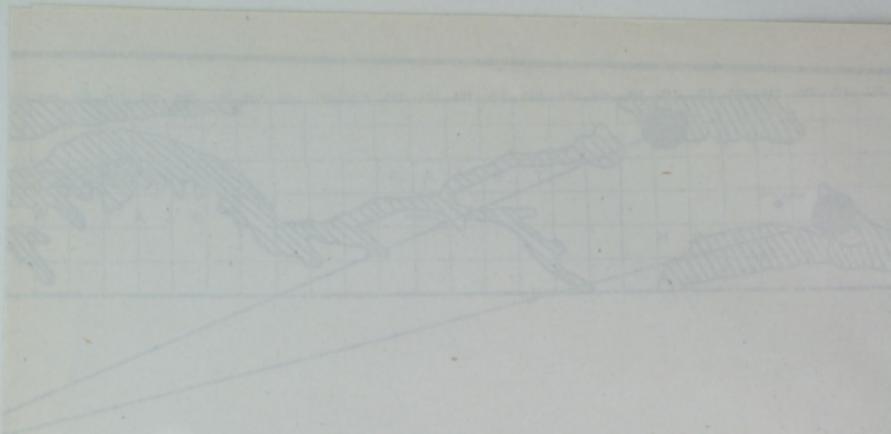
Neither species by itself will likely ever be able to support an open season because of the limited amount of range they can occupy singly. We can be more hopeful when both species are taken into consideration. The accompanying table (Table XI) shows approximately 27,500 as the population in 1941, of which almost 15,000 were lesser and 12,500 were greater chickens. Since the census with the lesser chicken was

would make for a total population of around 49,500 birds, which would allow a hunting take of 16,500 birds a season.

These figures show that the two species must be combined in hunting consideration, since a total take of around 40,500 birds appears to be about the best figures the state can realize. Obviously the sale of special licenses for taking prairie chicken would have to be limited to around 10,000 licenses allowing four birds per hunter. Hunting may be allowed however, when the one third possible take reaches around half of this number.

Any open season should be closely patrolled by rangers and definite sections designated for hunting, leaving sizable areas closed for protection.





LESSER AND GREATER PRAIRIE CHICKEN DISTRIBUTION AND DENSITIES

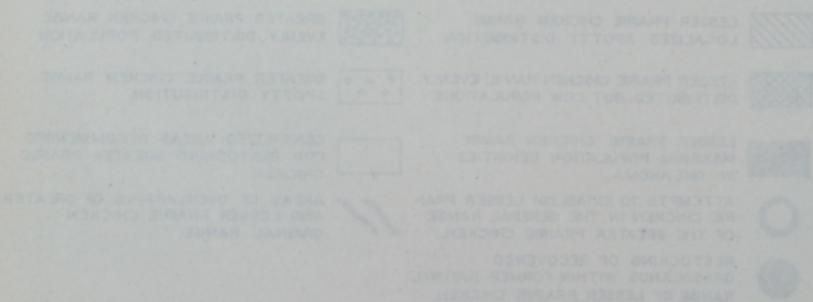


TABLE XI
PRESENT AND POTENTIAL POPULATION FOR PRAIRIE CHICKEN IN OKLAHOMA

Condition of Classification	Number of Birds	Density Birds per sq. mile	Square Miles	Percent of Area	Increase of Density by Management	Total Potential Population
Capacity Populations	4,980	31	158	3.7	31	4,980
Evenly Distributed Populations—low	8,494	6	1,233	29.2	20	24,664
Potential Range	1,440	0.5	2,820	66.9	15	42,300
Lesser Chicken	14,914			Potential Population Allow 1/3 for hunting take—		71,944 23,981
Greater Chicken	12,655	2	4,943	10 Potential Population Allow 1/3 for hunting take—		49,430 16,476
Total Present Population	27,569	Total range 9,154				121,374
Allow 1/3 for Hunting	9,189 or 2,000 licenses at 4 birds each		Total 1/3 take allowable for hunting			40,457 birds or 10,000 licenses at 4 birds each

CHAPTER V.

THE SCALED QUAIL

(Callipepla squamata pallida)

The scaled quail or blue or topknot quail is not an important game species in Oklahoma. Its importance lies in the fact that the species occupies a type of habitat not suitable to bobwhite, and in doing so, merely adds to the quail hunting acreage of Oklahoma. Regardless of its limited range and low numbers, the bird would never become so popular as the bobwhite. It does not lie well to a dog and has a habit of running rapidly on being disturbed, rather than freezing and then flushing. The bird is often very difficult to get into the air for wing shooting. Some hunters do prefer it, however, and this may be attributed to some extent to the picturesque country they inhabit.

However, since the portion of the state suitable for blue quail is not apt ever to support shootable bobwhite populations, the species warrants some serious attention.

HISTORICAL

There is a good deal of doubt as to exactly how much of the state this bird occupied in the past. (See accompanying map.) The workers have never been able to correlate the known range either past or present with any other possible influencing factor. However, situated as the Oklahoma range is, on the eastern margin of the natural distribution, a lack of stability in its ecology may be expected.

Strangely enough, there are very few accounts of "quail" in the early Oklahoma records which may definitely be referred to as Scaled Quail, even though the routes of many travelers extended across land which is now occupied by scaled quail. However, since partridges or quail is frequently mentioned in the various diaries, we may conclude that there was but little attempt to distinguish between this bird and the bobwhite.

On the other hand, a number of early settlers have reported that the species was abundant in certain sections before and at the time of settlement. Reports from Cotton, Beckham, Cimarron and Texas counties indicate that scaled quail were particularly abundant in these sections. Near Grandfield they were hunted for the market as early

as 1879, and old timers report that it was possible to bag 400 to 500 birds a day during times of winter concentrations. This species was also trapped and netted in Roger Mills county. They were abundant in Ellis county west of Shattuck before 1900, and in 1907 they were more numerous than bobwhite in northwest Texas county. Hunters report that around 1928 they were abundant near Muncy in Texas county.

After 1900 there were frequent attempts on the part of the game department and sportsmen to introduce this bird into more eastern parts of the state. These attempts have been liberally scattered over the state and amount to a rather fair sampling of the varied habitat. One factor, however, which may account for the failure to establish, has been the small number of birds released in each locality. However, evidence indicates that the problem is rather that of the failure of the species to adapt itself to the radical change of habitat.

PRESENT STATUS

The scaled quail is now absent from much of the range it once occupied. Substantial numbers equally distributed are found only in western Cimarron county, being closely associated with the Pinon-Juniper Mesa Type and the adjoining Shortgrass-High Plains and Sand Sage Types. Throughout the remainder of the range the birds are found only in scattered bunches, some of which are known to be results of introductions of stock.

Even in western Cimarron county the population is not stable at a high level. There appears to be much seasonal shifting as well as upward and downward fluctuations in total numbers. During the 1939 and 1940 hunting season, populations were good, but the 1940 season was followed by a decided decrease in concentrations around several ranches in February, 1941. And in the fall of 1941 populations were low. Generally, it appeared that the 1940 numbers were above those of 1939, which would appear to eliminate the severe winter of 1939-40 as being an important factor. In fact, such data as are available indicates that the decrease was merely the result of an early spring shift, and that concentrations during severe weather conditions leave an impression of high populations. However,

much information is needed on this species before its ecology is understood.

LIMITING FACTORS

Although far from complete, the information available on this species, indicates that the major limiting factor today is lack of suitable range. From interviews with local people throughout the range, it is seen that scaled quail generally disappeared over large areas during the drouth period of 1933 when food and cover were reduced to a minimum, and also when the native plant compositions were materially changed. However, since 1937, the species is coming to re-occupy much of the land since its recovery through favorable growing seasons. In isolated areas, however, it is impossible for the natural movement of birds to allow for a re-population of suitable range. (See map on page 88a.)

Other factors such as overshooting, predation and disease, commonly mentioned as contributing to low populations, are not believed to be important. Shooting may be important in some sections where coveys are isolated and populations very low. Protection from hunting is needed throughout the entire southwestern portion of the range for this reason. In fact, the only occupied range supporting populations sufficient to allow shooting is west of Boice City in Cimarron county.

RESTORATION OF SCALED QUAIL

After examination of the range, it was believed that some portions were sufficiently recovered from the effects of the drouth that restocking would materially aid the natural shift of the bird to move into suitable range.

The area of the present range stocked at a density adequate to serve as breeding stock is around 1,000 square miles. It is estimated that a total of around 5,000 square miles of land in Oklahoma may be figured potential range for this species in the state. Of course, much of this area must await natural recovery of habitat, yet there is some habitat improvement which will hasten this recovery which may be carried out by individual land operators. Most of this potential range is in the southwestern counties of Oklahoma.

During the late summer of 1941, the Division of Wildlife Restoration did the first experimental work toward restocking suitable range with scaled quail. The original stock was netted in Cimarron county and

used in the Darlington hatchery as breeding stock. An attempt was made to determine the eastern limit of suitable range and releases were made in Major county on the Mixed Grass Eroded Plains Game Type and in Beaver county west of Beaver. In 1942 work was begun on restocking based on the information received from the previous season's experimental work which was favorable. This consisted of releasing hatchery reared stock on areas throughout the panhandle counties. Again in 1942 the project was expanded and birds were released on refuge areas throughout the western and southwestern counties. A total of about 3,000 birds were released up to the 1943 season, and around 1,000 birds were then released.

RESULTS OF RESTOCKING

Data of sufficient reliability are available from thirty areas in Major, Beaver, and Texas counties, to enable the workers to evaluate at least the work in the northern part of the state. Here twelve releases showed establishment and increase over the original stock, eleven appeared as failures, and seven releases were indefinite. These later releases, in most cases, shifted and scattered to such an extent that observations were difficult. The eleven areas listed as failures, however, were ones in which no trace of scaled quail could be found for considerable distance of the release localities.

It appears, from the restocking information, that further releases in the northern tier of counties should not extend east of Harper county, since both historical records and recent investigations indicate that this is about the eastern limits of the tolerance of the species for northern Oklahoma. Sufficient time has not elapsed since the releases in southwestern Oklahoma to evaluate this portion of the work.

RECOMMENDATIONS

Recommendations for future work with this species must be based on the understanding that it is a game species of secondary importance, at least in its present status. In the long run, research is the cheapest step and, at present, the most needed work for scaled quail. There has been no extensive research done on this species anywhere from which to borrow information as is the case with bobwhite. It may be, when the facts of its ecology are understood, factors may be controlled toward making this species occupy an important place in the

game picture. For this reason, a limited restocking program is being carried on until such time as a research project can be initiated. This research project should intend to investigate life history, limiting factors, and management techniques of the scaled quail.

MISCELLANEOUS FIELD DATA

WEIGHT OF WILD-CAUGHT SCALED QUAIL FROM CIMARRON COUNTY, OKLA.

These birds were all netted or bait-trapped during the first week in February, 1940, on the Wilson Ranch, northwest of Boise City.

It is quite generally believed that scaled quail are considerably larger than bobwhite quail. The difference in average weights is not quite so great, however, as most sportsmen are inclined to think, being only approximately three-quarters of an ounce per bird on the basis of a limited number of weights. The actual difference in the average weight of birds taken at the same time

of year may be slightly more than that, since the average weight of scaled quail taken in February was compared with the average weight of bobwhite quail taken in November and December.

Average weight of 408 Bobwhite Quail taken in Woodward County during the months of November and December over a three-year period, 1939-40-41 6.2 oz.
Average weight of 149 scaled quail taken during February, 1940, Cimarron County 6.95 oz.
Difference in average weight75 oz.

From the weights of the same 149 scaled quail the following data were obtained:

Average weight of 149 birds 6.95 oz.
Average weight of 30 birds taken several miles from cultivated fields 6.63 oz.
Weight of smallest bird (only one) 5.5 oz.
Weight of largest bird (only one) 8.5 oz.

TABLE XII

TABULATION OF WEIGHTS OF 149 SCALED QUAIL

Weight in Oz.	Number of Birds
8.5	1
8.0	17
7.5	22
7.0	55
6.5	36
6.0	17
5.5	1
6.95 Average weight	149



Plate XLVII—Netting scaled quail in the wild to be used for hatchery brood stock.

CHAPTER VI.

THE MOURNING DOVE*(Zenaidura macroura)***INTRODUCTION**

The Mourning Dove (*Zenaidura macroura*) is an important game species in western Oklahoma. However, it has been only within recent years that it has been hunted extensively in the northern counties of this part of the state. From questionnaires received from the game rangers we find this species ranking third in popularity as a game animal, being below bobwhite quail and waterfowl, which ranked first and second respectively.

FACTORS AFFECTING ABUNDANCE

Undoubtedly man's entrance into the environment of the Mourning Dove resulted in some change on the part of the species. Although the bird does nest on the ground, we find that it prefers to nest in trees and that most nests are found here. On this basis we believe that the widespread "shelter belt" planting participated in by the early settlers of western Oklahoma served to increase nesting of doves in the great expanse of treeless plains found in western Oklahoma. Today, even though some of these plantings have been killed by drouth and other causes, doves continue to use them for nesting sites.

The vast acreage cultivated to wheat appears to have favored doves, or at least has served to supply them with an abundant food source until harvested, and whether this results in concentration which suffers at wheat harvest is not known. However, the flight capacity of doves would lead us to believe that, after harvest, doves simply fly farther for food than before.

Overgrazing, particularly of the shallow sandy soils, also appears to benefit doves since on these soils are produced great amounts of their favorite foods. That is, dove weed (*Croton* sp.) and ragweed (*Ambrosia* sp.). Doves are able to utilize these situations much more so than are such ground living birds as bobwhite, since the presence of cover adjacent to the feeding area is not necessary.

In general, it is believed that the agricultural activities of man have been of benefit to mourning doves in western Oklahoma. It has resulted in a greater production of

those seed producers used as food by the species and in greater number of nesting sites.

POPULATIONS IN WESTERN OKLAHOMA

During August, 1940, an attempt was made to get roadside counts in western Oklahoma to show the relative population densities of the various game types at this particular time of the year, since dove hunting season usually opens September 1. Routes were laid out running parallel across the region from south to north. This made possible the crossing of each game type for every trip as progressing from west to east.

Speed of travel varied with the kind of cover, counting being of course, much easier at a higher rate of speed on the plains than in forested country.

Although densities expressions are, it is believed, accurate within use by this method of count, there are too many variables to enable one to get population estimates. Roadside counts appear to be seldom representative of actual populations. Yet the roadside count could, if desired, give increase and decrease in terms of per cent of change from year to year, which is what field workers are mainly interested in, particularly with large populations.

RESULTS OF ROADSIDE COUNT

A total of approximately 1,400 miles were traveled during the count. Counts were made from sunrise to sunset, which, of course, involves some treatment of time of day, should one be interested in detailed consideration of densities. For this work, however, we have merely shown the average dove per mile density for each game type.

The following diagram gives the results of the count in terms of average dove per mile densities for the game types. The Floodplain-Stream Influence Type is seen to greatly exceed the others with an average of 6.5 doves per mile, of the total miles of the type traversed. The Stabilized-Dune of western Oklahoma ranks second with an average density of 3.3 doves per mile. The Sand-Sage Game Type was found to show an average density of 2.5 doves per mile. The Tallgrass (cultivated) Game Type, Shinnery Oak Game Type, and Mixed Grass Game Type were found to show near the same densities with

TABLE
RESULTS OF MOURNING DOVE ROADSIDE
COUNT IN WESTERN OKLA.

AUGUST, 1940

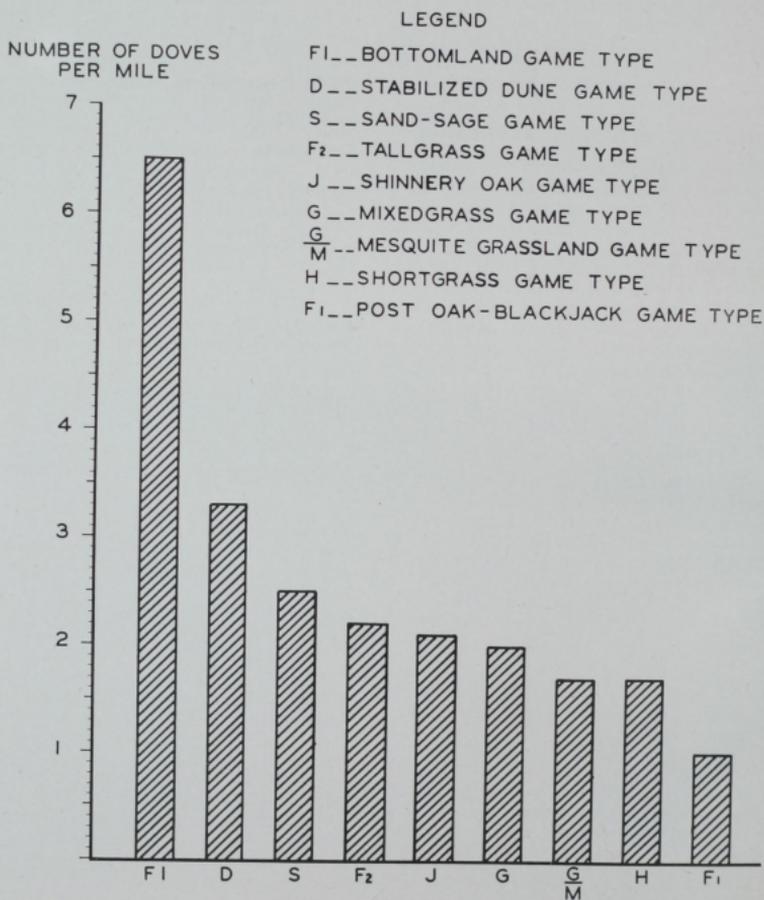


CHART III.

TABLE
 SHOWING BREAKDOWN OF DOVES PER MILE
 ON STREAM INFLUENCE WITHIN MAJOR
 GAME TYPE OF WESTERN OKLA.

AUGUST 1940

NUMBER OF DOVES
 PER MILE

LEGEND

- $\frac{F_1}{H}$ --- STREAM INFLUENCE WITHIN SHORTGRASS GAME TYPE
- $\frac{F_1}{S}$ --- STREAM INFLUENCE WITHIN SAND-SAGE GAME TYPE
- $\frac{F_1}{G}$ --- STREAM INFLUENCE WITHIN MIXEDGRASS GAME TYPE
- $\frac{F_1}{F_2}$ --- STREAM INFLUENCE WITHIN TALLGRASS GAME TYPE
- $\frac{F_1}{E_1}$ --- STREAM INFLUENCE WITHIN POSTOAK-BLACKJACK GAME TYPE
- $\frac{F_1}{D}$ --- STREAM INFLUENCE WITHIN STABILIZED DUNE GAME TYPE
- $\frac{F_1}{GM}$ --- STREAM INFLUENCE WITHIN MESQUITE-GRASSLAND GAME TYPE

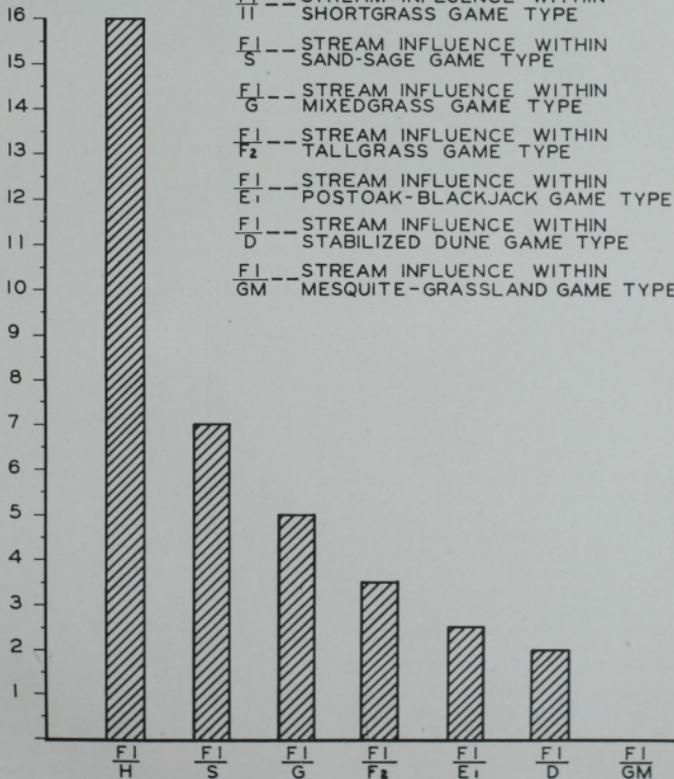


CHART IV.

2.2, 2.1, and 1.9 doves per mile respectively. The Mesquite grasslands and Shortgrass Plains Game Types were found to show 1.6 doves per mile each. The Upland woodland gave the smallest figure with an average of 0.9 doves per mile. Table XIII gives the miles traveled and doves counted per type with the averages.

Forest Service and certain work of the Soil Conservation Service are doing much to develop nesting sites in areas where they formerly were very scarce.

Management of the Mourning Dove may well be included with any future program involving bobwhite as the principal species

TABLE XIII
TABULATED RESULTS OF THE ROADSIDE COUNT,
WESTERN OKLAHOMA, AUGUST, 1940

GAME TYPE	Miles Counted	Total Number Doves	Average Number Doves Per Mile
Shortgrass Plains	52	84	1.6
Eroded Mixed Grass	280	532	1.9
Tallgrass (cultivation)	218	496	2.2
Sand-Sage	176	456	2.5
Stabilized Dune	24	80	3.3
Shinnery Oak	170	366	2.1
Post Oak-Blackjack	180	176	0.9
Stream Influence and River Bottom	44	290	6.5
Mesquite-Grassland	298	462	1.6
Totals	1,442	2,946	

Since the stream and river vegetation should, we believe, be considered merely as an influence within the type through which it moves, in this case we have attempted to break down the high dove per mile count for this condition into figures showing the relation of the stream densities with that of the adjoining major game type. (See diagram). This gives a proportionment which, on paper, may appear surprising, but which appeared evident in the field at the time of the count. The Shortgrass Plains Type shows the highest per mile population on the stream influence. This may be explained partly by the small number of forested streams in that area, and by the relatively small number of farm woodlots and roadside planting. This may possibly cause a concentration of birds around the areas with some of the larger vegetation. This same trend of reasoning appears to hold for the rating of the Sand Sage Type as second place, and the Mixed Grass Type as third

In fact, all farm game species such as bobwhite, mourning dove, cottontail rabbit and squirrel may be treated under the same unit management plan when and if the game department sees fit to do so.

The present laws regulating hunting of the Mourning Dove in Oklahoma seem adequate. Many persons advocate starting the season later than September 1, since some doves are still nesting at this time. However, we would not recommend a change in laws until there is information to show that a sufficiently large production results from this late nesting to warrant protection. Dove populations, insofar as western Oklahoma is concerned, seem dense enough to support a good deal more shooting than is now the case. Although we do not know how our resident nesting doves compare in numbers with those migrating in from the north, there is little doubt that the numbers seen here do not represent Oklahoma's share of the annual dove crop.

MANAGEMENT RECOMMENDATIONS FOR MOURNING DOVE IN WESTERN OKLAHOMA

Work during the course of the Game Survey with the Mourning Dove was hardly of the nature as to contribute to its management. Shelter belt plantings of the United States

inssofar as our experience goes with dove hunting, overshooting the legal limit does not seem to be even as big a factor as with bobwhite quail. Doves are a much more difficult target for most hunters, and their habits make them less vulnerable to "pot-shooters."

CHAPTER VII.

WILD TURKEY*(Meleagris Gallapavo silvestrosus)***INTRODUCTION**

Wild turkey did not receive the attention during the course of the survey that it should have. After a preliminary examination of the conditions in Oklahoma as compared with those of certain adjoining states attempting to restore this species, it was seen that the problem was too complex and lengthy to arrive at definite recommendations during the allotted time. Some idea of the present population is available, however, along with other information.

FORMER DISTRIBUTION

In former years the eastern wild turkey was present in Oklahoma in vast numbers. According to Nice (1931) they were an abundant resident throughout the whole state except the two western counties of the panhandle.

It is believed by the workers, however, after a cursory examination of the early literature, and after interviewing many early settlers, that eastern wild turkey extended across the state throughout the body of the state and may have been rarely encountered throughout the length of the Cimarron. It appears that this bird extended west up the Arkansas to the north across the great plains and probably overlapped with the Rocky Mountain turkey somewhere. And since Rocky Mountain turkey are known today within sixty miles west of Kenton, Oklahoma, it appears not unlikely some overlapping may have occurred on the Cimarron river. Also the habitat of certain sections of western Cimarron county suggests the thought that Rocky Mountain turkey may have occurred there. Records are: James in 1820, Irving and Latrobe in 1832, Cregg in 1839, Albert in 1845, and Woodhouse in 1850. All spoke of the abundance of these birds. In 1887 General Sheridan visited a roost three miles long on the Canadian river. Cook found them very common in the bottomlands a few miles from Caddo in 1883. But in 1886 near Fort Gibson they "seemed rather hard to get as the supply has not been kept up" (Potter). Huntington (1903) says "they (wild turkey) were probably as abundant in the Indian Territory a few years ago as anywhere". With the advance of civilization and settlement in Oklahoma, the wild

turkey population receded in later years (1890 to the present) and now are found only in the mountainous region of the southeastern counties in the Oak-pine food and cover type. Information received from old hunters living in the Oak-pine Forest indicates that the population decreased slowly but steadily until 1920, after which a sharp decrease was noted. By 1925 the wild turkey was considered by many as extinct in Oklahoma. However, the species is not extinct and some few are killed illegally each year.

PRESENT DISTRIBUTION AND ABUNDANCE

The ranges now occupied by the wild turkey in Oklahoma are in the wildest and most secluded areas of the state. They are located in the Oak-pine food and cover Type discussed in the type mapping report. In this area there are two principal east-west trending chains of mountains known as the Kiamichi and the Winding Stair. South and southwest of these ranges there is a large number of individual mountains which belong to the same mountain region (Ouachita). These mountains rise as much as 1800 feet above the valley floor and are heavily wooded. The surviving flocks of wild turkey are scattered in isolated groups throughout this area. This region covers the six southeastern counties of Pushmataha, LeFlore, Pittsburg, Latimer, Atoka and McCurtain. Table XIV indicates present location of turkey.

INVENTORY

During a portion of April and May, 1941, a check was carried on to determine the standing of the wild turkey in eastern Oklahoma. This survey was also for the purpose of determining present and potential distribution. During this time the biologists were greatly inconvenienced by inclement weather, hence not as complete a check was obtained as was desired. Survey was conducted in the six southeastern counties mentioned above. The first step in the survey procedure was to contact all state game rangers and local residents in this southeastern district who could give some information on the wild turkey. All known turkey supporting areas were located on general highway transportation maps, scale one-half inch to the mile. With these maps

it was possible to locate the flocks accurately in relation to roads, rivers, ridges, section lines and other physiographic features.

Each county supporting turkey was worked as a unit. All data, such as turkey locations, number in flock, history of turkey in area, and topographical features of the area, were studied before checking. The areas were checked by going into the section where the turkey were supposed to be and locating the flocks by means of gobblers and tracks. These wild turkey locations and estimates of numbers as given by state game rangers, are given in Table XIV, and are considered to be reasonably accurate.

is under surveillance from towers. There are two principal fire seasons—one from late January to June, the other from August to November. The spring period is extremely detrimental to the nesting season (see Plate I), and the fall period to the very important mast crop.

ACCIDENTS

No data are available on accidents to the species and this is considered a minor factor.

WEATHER

All other factors being equal, the weather is not an important one. No severe win-

TABLE XIV
WILD TURKEY LOCATIONS AND STATE GAME RANGERS ESTIMATES

County	Sections	Twp.	Range	Game Rangers' Population Estimates
Pushmataha	15, 16, 21, 22, 23, 26, 27	2N	21	60
"	11	3S	17	35
"	21, 22, 27, 28	3S	21	15
"	6	3S	18	?
"	4, 5, 8, 9	2N	22	15
Le Flore	33, 34, 35	2N	24	?
"	3, 4	2N	25	?
"	5	1N	26	15
"	9, 16	1N	25	20
"	13	1N	24	5
Latimer	1, 2, 10, 11, 13, 14	6N	19	20
"	1, 12	3N	18	?
"	6, 7	3N	19	?
Latimer	1, 2, 3, 4, 9, 10, 11			
Pittsburg	15, 16, 22, 14	3N	17	
"	34, 35, 36, 25, 26, 27			
"	23, 24, 13, 14, 15	4N	17	
Atoka	1, 26	2S	13	30
McCurtain	22	3S	24	1
"	36	5S	25	5
"	Possible Loc. 35	1S	24	?
"	" " 2	2S	24	?
"	" " 30, 31	4S	23	?
"	" " 1	5S	24	?
"	" " 6	5S	25	?

FACTORS AFFECTING ABUNDANCE

The limiting factors mentioned here are not to be considered as the only ones responsible for the reduction of the wild turkey population, but as factors that in general have affected and are affecting all game species in this forested section of eastern Oklahoma. All of the following factors played some part in bringing about the decrease in wild turkey, and affect the numbers at present.

FIRE

This entire area is subject to extensive and destructive forest fires, although it is patrolled constantly and most of the area

ters occur in this area and there is very little snowfall.

POACHING

In former days market hunting for the wild turkey was popular and many thousands were killed. The practice of turkey hunting has grown into the nature of the native settler of southeastern Oklahoma and it will be eliminated only with difficulty. This will call for a more strict enforcement of the laws and an educational program among the settlers of the area.

PREDATORS

With game populations at a normal level, predation would not be an important factor,

but with it at its low ebb, any individual taken is important. Studies in Missouri have indicated that the fox is probably the most detrimental predator, and all indications are that this holds true in Oklahoma. There are no data on the number of individual turkeys taken early in this state.

GRAZING

As it affects the wild turkey, the greatest damage done by concentrated grazing lies in the disturbance and limitations of the natural growth and abundance of ground food and cover plants used by the turkey, and in the undesirable use by cattle and hogs of available water sources, and nest disturbances. The degree of this interference in Oklahoma has not been determined.

FOOD AND COVER

Other than on areas of concentrated grazing, there appears to be no scarcity of either food or cover. However, no range analysis has been made in this area, and this should be one of the first steps in a management program in Oklahoma.

POTENTIAL RANGE

There are in eastern and southeastern Oklahoma large areas of unsettled and isolated country well suited for restoration purposes. Much of this land is totally unsuited for agricultural use and is, at present, used only for grazing and timber products. This potential range is in the two wildlife food and cover types of Oak-pine and Oak-hickory. (See map following chapter.) Although there are a number of small blackjack, post-oak and bottomland areas that might serve to support turkey, the most immediate restoration work should only include the sections recommended above until populations have been built up on them.

ATTEMPTED RESTORATION

The only source of information from which past attempts of restoration are known are the biennial reports of the game and fish department. Although these records do not say so, apparently some stock had been placed on the Davison Ranch in Ellis county prior to 1930, since mention is made of their increase in the report of 1930-32. Despite the fact that, at present date, other areas in the vicinity of the Davison Ranch show some promise, practically all the birds on this area have disappeared. In the same report (1930-32) mention is made of rapid increase of turkeys on what is now the Wichita Wildlife Refuge.

In February, 1934, the game and fish department established a turkey farm near Tahlequah, Oklahoma. A brood stock of twenty additional birds from the Wichita National Forest and twelve young birds from Mr. Lew Wentz's place were placed here and the eggs, in lots of 100, were hatched by a commercial hatchery in Muskogee. It was reported that mortality of young poult was kept below 10% of the eggs hatched.

During the biennium of 1934-36, 501 half-matured turkeys were released throughout eastern Oklahoma, distributed as follows:

Carter county	6
Cherokee county	50
Comanche county	4
Delaware county	35
Grady county	3
LeFlore county	101
Latimer county	25
McCurain county	175
Nowata county	12
Oklahoma county	15
Pushmataha county	60
Sequoyah county	15
TOTAL	501

Also during this biennium the turkey farm was discontinued at Tahlequah and the brood stock consisting of 22 hens and 10 gobblers was moved to the Darlington quail farm. Mention is made that the department anticipated keeping an additional 45 hens and 18 gobblers from the hatch for brood stock. No further record is made of the turkey rearing and since no records of release appear in subsequent reports, it is assumed that, for some reason, the entire project was abandoned.

In 1940-42, 200 young turkeys were purchased from a breeder in Missouri and released in Atoka, Pushmataha, Latimer and McCurtain counties.

RESULTS

It appears that the earlier attempts at turkey restocking resulted in failure. All known releases were checked and no evidence found of survival except on the McCurtain County State Game Preserve. Mr. Surrell, the superintendent, says, "All of these turkeys were infected with some disease and died of it." He carried off and disposed of most of these birds after they had died near his home.

The releases of 1940-42, consisted, for the most part, of travel-worn birds. They were crated and in rough board crates which allowed them to skin and scrape themselves severely. Around 15-20 birds died enroute and many others were hardly able to stand

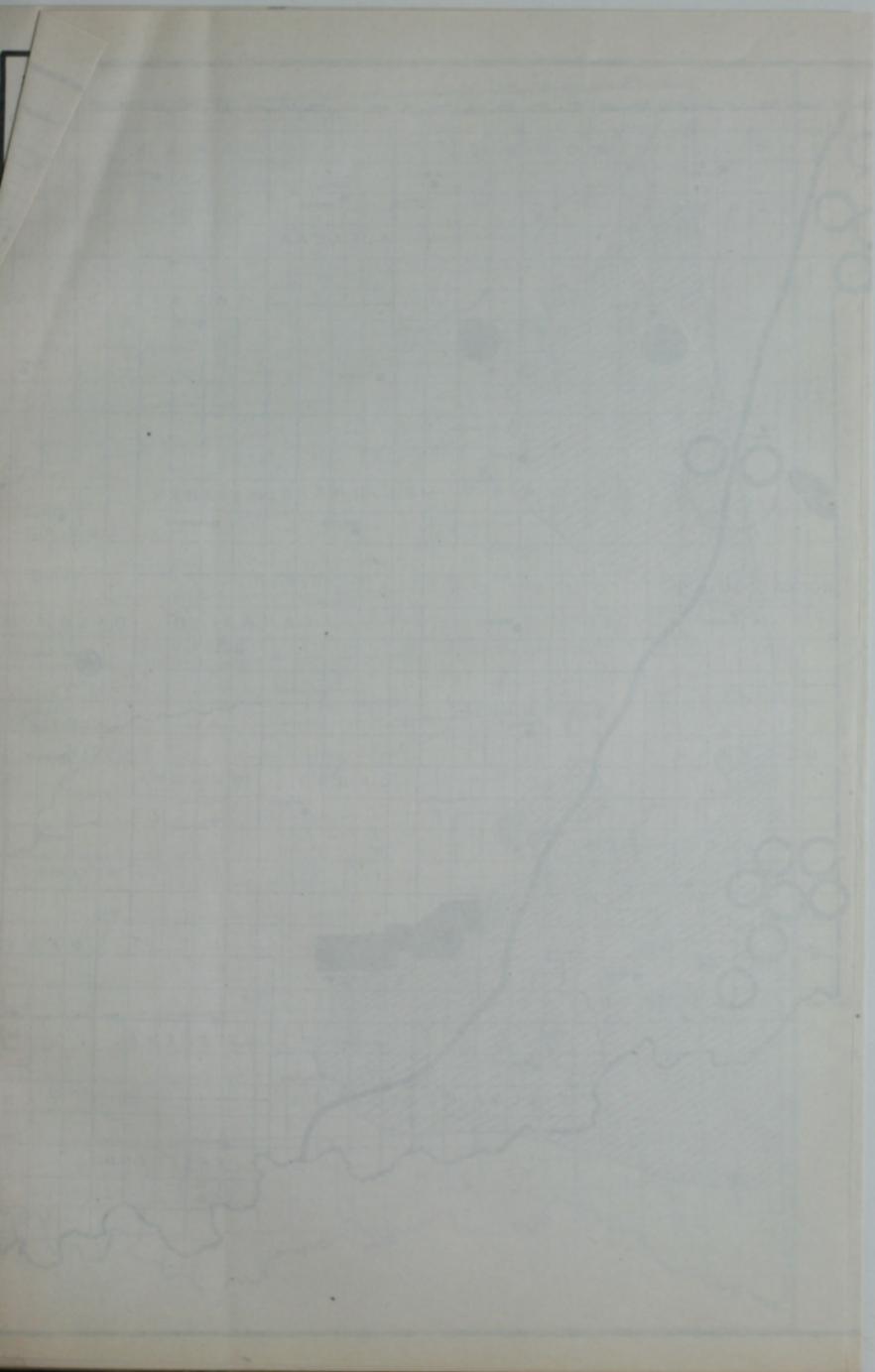
when released, so their chances of survival were seriously reduced to start with. However, there is some indication of establishment of a few birds where protection is given.

THE FUTURE FOR TURKEY IN OKLAHOMA

It is apparent that the mere release of turkey stock will not bring numbers back to where hunting can be permitted. Information on this species is so meager, insofar as Oklahoma conditions are concerned, that of first demand is a fact-finding project by which the requirements and controlling factors of the bird can become better known.

Another concern associated with restoration by bringing in turkeys from elsewhere is difficulty of getting good stock of wild birds. Most commercial turkey stock is contaminated with domestic strains.

Areas where turkey populations may be recovered are confined largely to the more inaccessible portions of the Oak-pine game type of southeastern Oklahoma and the Oak-hickory game type of northeastern Oklahoma. There is sufficient acreage of excellent habitat conditions in these two areas to support a shootable turkey population, once the fundamental problems of its ecology are solved.



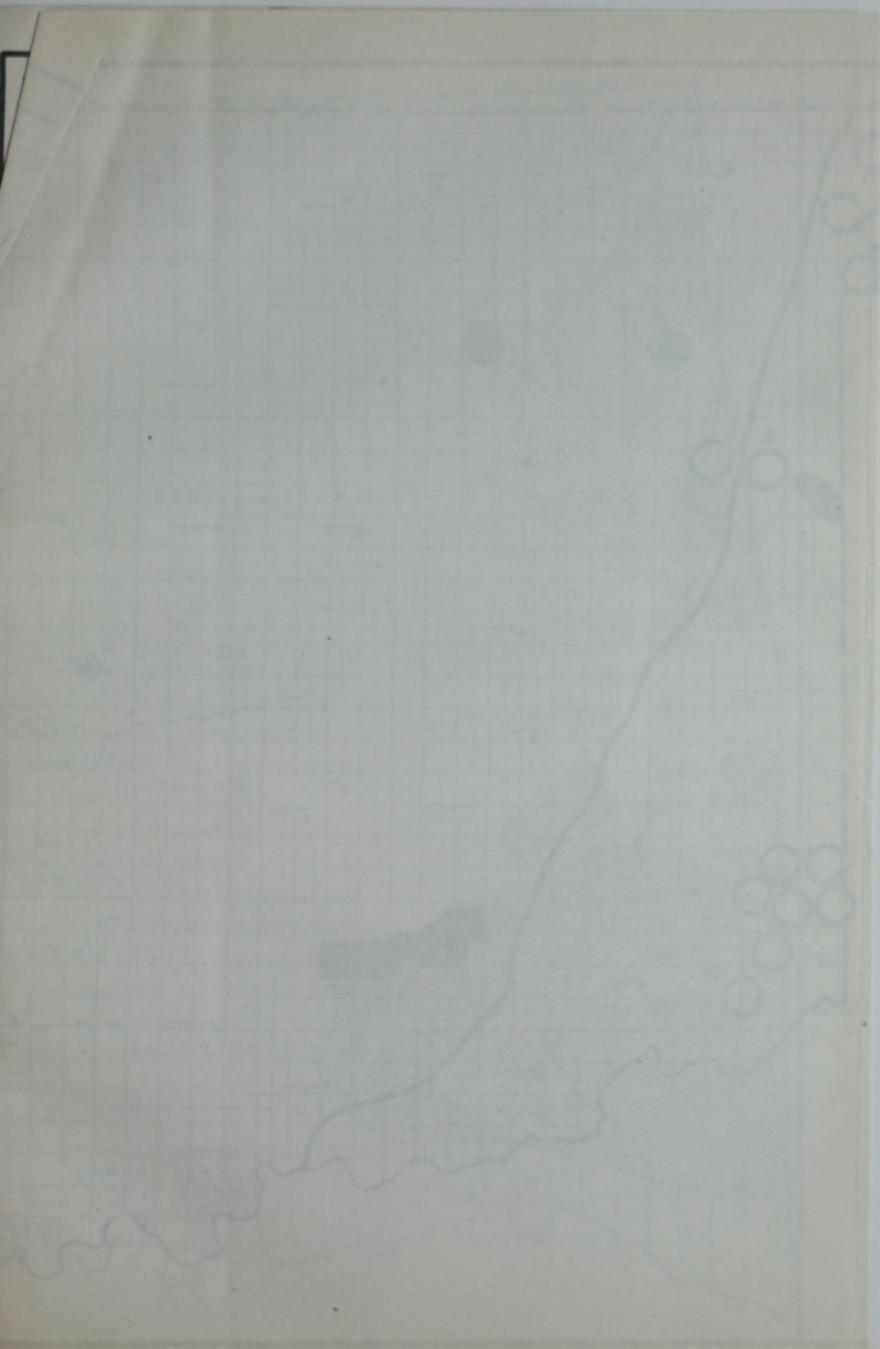
when released, so their chances of survival were seriously reduced to start with. However, there is some indication of establishment of a few birds where protection is given.

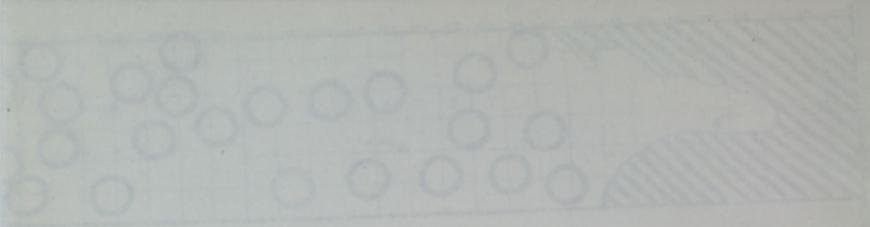
THE FUTURE FOR TURKEY IN OKLAHOMA

It is apparent that the mere release of turkey stock will not bring numbers back to where hunting can be permitted. Information on this species is so meager, insofar as Oklahoma conditions are concerned, that of first demand is a fact-finding project by which the requirements and controlling factors of the bird can become better known.

Another concern associated with restoration by bringing in turkeys from elsewhere is difficulty of getting good stock of wild birds. Most commercial turkey stock is contaminated with domestic strains.

Areas where turkey populations may be recovered are confined largely to the more inaccessible portions of the Oak-pine game type of southeastern Oklahoma and the Oak-hickory game type of northeastern Oklahoma. There is sufficient acreage of excellent habitat conditions in these two areas to support a shootable turkey population, once the fundamental problems of its ecology are solved.





WILD TURKEY AND SCALED QUAIL

WILD TURKEY
MINOR POTENTIAL WILD TURKEY RANGE
IN OREGON

LOCATION OF FLOCKS

SCALED QUAIL
EASTERN LIMIT OF ORIGINAL RANGE
OF SCALED QUAIL

AREA OF SCALED QUAIL
POPULATION

LOCATION OF FLOCKS AND ATTEMPT TO
RESTORE SCALED QUAIL OR RECOVERED RANGE

RESTORATION ATTEMPTS RESULTING
IN FAILURE

CHAPTER VIII.

RINGNECKED PHEASANT

INTRODUCTION

There has probably been more money and effort expended in attempts to establish ringneck pheasant into localities in the United States than on any other game species. Notable success to date from such introduction has occurred, generally only, in the United States north of Kansas. Locally, establishment is known for areas south of this line, but introductions in the main here have resulted in failure.

In Oklahoma, Nice (1931) in quoting apparently some official or printed matter of the game and fish department, says "from 1911 to 1916 an honest, earnest effort was made to stock the state with ringnecked pheasants, hundreds of mature birds and thousands of eggs for hatching were issued to different farmers and sportsmen of the state, during the next two years several dozen birds were planted." In 1926, 2,100 birds were turned loose, and no mention is made in the biennial report as to the locality. In 1930 Nice reports 666 pheasant again released in northwest Oklahoma. The report of the department for 1934-36 mentions a release of 131 adult birds and 289 eggs distributed at the same time. It is known that birds have been purchased and released since this last record, and also that the total private participation probably exceeds even that of the department.

It is believed that some pheasants have been released in every county of the state at some time since 1910. Private individuals, as well as sportsmen's clubs, have been active in introducing this bird to the state.

It is interesting to note that before 1941 establishment of stock was confined almost entirely to the northern tier of counties, including the panhandle. Since 1941 populations west of Alfalfa county, particularly in Beaver, Texas and Cimarron counties, have shown an astounding increase. Throughout this section today pheasants are common and increases are noticed south to the Washita on the western side of the state, and eastward to southeastern Major county.

In the history of pheasant stocking in the United States, various degrees of success and failure have been noted. Leopold (1937) classifies these somewhat modified after a study of Phillips (1928).

TYPES OF FAILURES

- (a) Planted stock immediately disperses and disappears without breeding (dispersal failure).
- (b) Planted stock breeds for one or two years (often vigorously the first year) and then persists as nonbreeding adults, and gradually disappears.
- (c) The stock persists as a small breeding colony, but does not spread. It usually eventually disappears.

TYPES OF PARTIAL SUCCESS

- (d) Stock persists and sometimes spreads, but only with aid of artificial propagation or the addition of new plants or both.

TYPES OF SUCCESS

- (e) The stock breeds and spreads, (sometimes vigorously at first), but experiences a subsequent partial decline to a lower level.
- (f) The stock promptly and vigorously breeds and spreads and shows complete establishment as a wild population.

In the past, most of Oklahoma's attempts at pheasant stocking have exhibited the characteristics of failure under A. Leopold's Classification. The present increase, however, has not extended over sufficient time to determine if it is permanent or not.

However, it is believed that, aside from unknown environmental factors which control pheasant increases, the present population in northwest Oklahoma may be attributed almost entirely to the huge pheasant stocking program carried on by the Kansas Fish and Game Commission across the line in southwestern Kansas.

The populations should be followed closely by technicians capable of interpreting influencing factors in order that the pheasant problem may be properly evaluated. It may be that limited stocking—that is, limited areas with sufficient birds—should be carried out south of the region of present increase in an attempt to take advantage of the apparently favorable conditions making for pheasant increase.

CHAPTER IX.

AMERICAN WOODCOCK
(*Philohela minor*) Gmelin
FORMER DISTRIBUTION

This bird ranged throughout the eastern edge of Oklahoma, but in small numbers and was never heavily hunted. M. M. Nice (1931) says that the American Woodcock was probably a former breeder in southeastern Oklahoma. This is probably true since they have been recorded as nesting in Kansas and Arkansas.

This game bird is found only in low swampy or marshy areas, near timber. After checking historical data of this game bird and comparing them with our vegetative type map, it appears that the woodcock was a resident along the streams of southeastern Oklahoma, as well as the Arkansas, Grand and Illinois rivers and their tributaries.

**PRESENT DISTRIBUTION AND
ABUNDANCE**

The population of the woodcock in Oklahoma is so low and its importance as a game bird so slight, that no censuses to estimate the total population were attempted. However, all observations were recorded and are listed below.

It is quite obvious that all observations were made in the bottomland food and cover types. The present distribution has changed but little from the former. However, the size and quality of the present range is very small and poor when compared with that of the former. The best woodcock habitat, which was the marshy condition adjacent to streams supporting a heavy growth of bottomland timber, has been converted into some of the most productive farm land in the state. A high percentage of this land has been cleared and drained, and the remainder will be treated likewise in the near future.

**POPULATION TREND AND RELATION
TO LAND USE**

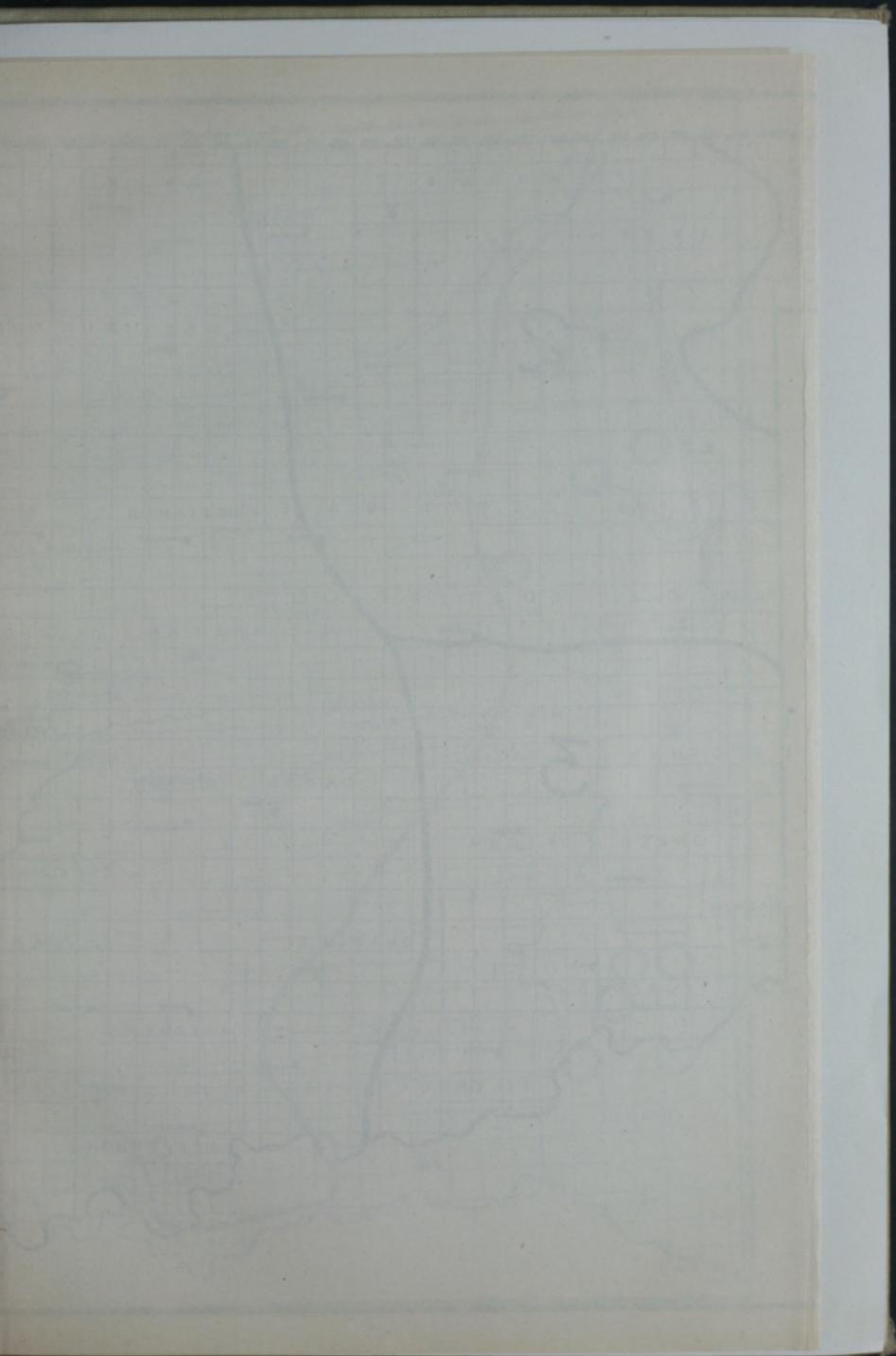
The numbers of woodcock in the state are gradually decreasing, primarily because of habitat destruction. The draining and clearing of suitable land is making it more undesirable for the birds to stop off on their migratory trips, and to winter. The low winter populations of the bird in this state will never allow it to become important as a game bird.

For a number of years a fifteen day open season has been provided by federal regulations. Very rarely is a bird taken in Oklahoma. In fact, it is recognized by only a few, so this hunting season provided little sport and has very little effect on the population.

TABLE XV
WOODCOCK OBSERVATIONS

Number	Date	Type and County	Location
1	2-28-40	Bottomland-Oak Pine McCurain county	Sec. 3, Twp. 1S, R 23E
2	3-1-40	Bottomland-Oak Pine McCurain county	Sec. 3, Twp. 3S, R 25E
1	3-4-40	Bottomland-Oak Pine LeFlore county	Sec. 4, Twp. 1N, R 25E
1	3-5-40	Bottomland-Oak Pine McCurain county	Sec. 2, Twp. 3S, R 22E
1	10-18-40	Bottomland-Oak Pine McCurain county	Sec. 20, Twp. 1N, R 24E
2	2-28-41	Bottomland-Oak Savannah Muskogee county	Sec. 24, Twp. 14N, R 20E
1	3-8-41	Bottomland-Oak Hickory Cherokee county	Sec. 23, Twp. 17N, R 23E
1*	11-24-41	Bottomland-Oak Hickory Adair county	Sec. 10, Twp. 18N, R 25E

* Killed by hunter, hunting quail



PHEASANT & WOODCOCK

GENERAL SALES & SERVICE
10 EASTERN DISTRICT

1001 BROADWAY
NEW YORK 10

1. THE WOODCOCK AND THE PHEASANT
2. THE WOODCOCK AND THE PHEASANT

3. THE WOODCOCK AND THE PHEASANT
4. THE WOODCOCK AND THE PHEASANT

5. THE WOODCOCK AND THE PHEASANT
6. THE WOODCOCK AND THE PHEASANT

CHAPTER X.

MISCELLANEOUS GAME BIRDS
CHUKAR PARTRIDGE

(Alectoris graeca chukar)

The newest game bird to be introduced into Oklahoma is the chukar partridge (*Alectoris graeca chukar*), of which the first releases were made in the fall of 1939. More extensive releases were made in the summer and fall of 1940, after which the raising and releasing procedure was abandoned. Approximately 5,000 birds of 1939 and 1940 releases were checked in the fall of 1941. In no case were encouraging results met with. Breeding success appeared to be almost zero and brood survival even less. The usual report regarding each release was that the birds left very quickly after release, or else they would stay fairly close to the farmstead, gradually dwindling in numbers and disappearing. On only several instances were we informed by the landowner that occasionally a bird was still seen (fall of 1941). Although it is too early to arrive at a final decision regarding the introduction of this species, it is quite apparent that the introduction is well on the road to failure. The results of restocking with this bird in Oklahoma appear to be in accord with that found out for most of the other states that have attempted to introduce this species.

SAGE HEN

(Centrocercus urophasianus)

The sage hen was formerly a rare resident of the sagebrush country of the Oklahoma panhandle. The last specimen was taken in Woods county in 1930. It is possible that a very low population might be maintained in certain portions of the sagebrush pastures of western Oklahoma, but it is extremely doubtful that the bird could ever be expected to occupy a place as a hunted species.

PRAIRIE SHARP-TAILED GROUSE
(Pedioecetes phasianellus campestris)

The prairie sharp-tailed grouse once occurred in some numbers in Cimarron county north of the Cimarron river. It is possible that a few of these birds might yet be maintained, but never in such numbers as to be of hunting value. Hence, the species would not warrant any serious attention.

PASSENGER PIGEON

Our last record of this species in Oklahoma was in northern Ottawa county in 1857. Other records go back as far as 1819—one in Mayes county, Salt Creek and Arkansas river; Garvin, Murray and McClain counties. This bird is now extinct but was once shipped in enormous numbers to eastern markets.

CAROLINA PARAQUET

This little known bird, now extinct, was once found in Oklahoma. Records are available from Shawnee Hills, 1819; Canadian River at Gaines Creek, 1819; Bitter Apple Creek, 1819; Goose Neck Bend of the Arkansas River, 1838; Antelope Hills, Rogers Mill County, in 1853.

WATERFOWL

Some cooperative banding work was carried on with Hugh S. Davis, Mohawk Park, Tulsa, Oklahoma. Mr. Davis has given a report on the number and kind of ducks trapped at Mohawk Park during the past trapping seasons.

Oklahoma has only a small number of breeding waterfowl and most of the common species migrate through the state. The number and kind of ducks trapped by Hugh S. Davis gives a good index of the kind and number of ducks migrating through eastern Oklahoma.

The following number and kind of ducks were trapped by Hugh S. Davis, Mohawk Park, Tulsa, Oklahoma over a period beginning December, 1938, through the season of 1939-40 and the spring of 1941.

SPECIES	Male	Female	Total
American Merganser ..	50	95	145
Hooded Merganser ..			1
Mallard	3,158	2,087	5,245
Black Duck	11	11	22
Gadwall	5	3	8
Baldpate	115	120	235
Green Wing Teal	209	152	361
Blue Wing Teal	464	158	622
Shoveler	13	3	16
Pintail	1,408	663	2,071
Red Head Duck	17	9	26
Canvasback			2
Lesser Scaup	14	22	36
Ringneck Duck	130	111	241
American Coot	?	?	98
GRAND TOTAL			9,121

CHAPTER XI.

THE WHITETAIL DEER
(Odocoileus virginianus louisianae)

The whitetail deer was formerly present over the entire state with the exception of the Shortgrass Highplains Game Type in the panhandle counties. However, it was associated with the brushy sand dune condition and river bottoms within these counties.

It is noticeable that deer became less frequently mentioned in the literature of the early traveler of the state as they moved west. Yet, through most of the state deer meat seemed a substantial part of the diet of these people prior to 1870.

The whitetail deer is a wildlife resource representing a real potential worth to the people of the state. Probably no other game species is in a position to react so readily to good treatment. The population is low, most of the important limiting factors are known, and the range for expansion is relatively large. From the results of this survey the workers are prepared to predict that deer can become the number two game animal, if not the number one, of the state.

DEER CENSUS AND SURVEY

During the period February 13 to March 15, 1940, the deer range in southeastern Oklahoma was investigated to determine the population and to study the limiting factors in relation to future management. Atoka, Latimer, LeFlore, McCurtain, Pittsburg and Pushmataha were the six counties included in the detailed survey since they were open to hunting between November 11-17, 1939. Too, the subsequent season of November 9-13, 1940, following the census, allowed for better examination of the results.

The "cruising method of census" was used on this work. It offered the most accurate determination under the existing conditions of limited manpower. A total of fifteen census areas were established within the deer range scattered over five counties. Fourteen were four square miles in size and one was two square miles in size. Field studies revealed that areas of two square miles are too small for good deer sample areas in this type. Each area was selected so that typical representation of human population, agriculture, number and class of roads, topography and hunting pressure could be evaluated. Censuses were run on

these sample plots by two census takers, following census lines run with a compass in cardinal directions. The lines were run at one-half mile intervals, since the average running distance of deer was determined previously to be approximately one-fourth mile. Pedometers were used to measure distances. Two hundred and forty miles of census lines were traveled, or an equivalent of fifty-eight square miles. Incidentally, a prior figure was arrived at by interview with game rangers and others acquainted here. It is interesting to mention that almost without exception these local people estimated a figure slightly lower than that arrived at by the workers.

Populations were based on number of deer seen and amount of deer sign observed on the census lines. Complete notes were taken on all deer flushed and on signs, such as tracks, pellets, scrapes and evidence of browsing. Notes were also taken on the flushing distances and other factors pertinent to determining the population. The population on each area was then computed by use of King's Ruffed Grouse Formula which has been adapted to deer work.

The populations will be discussed separately for each county or district.

McCURTAIN COUNTY

The present deer range in McCurtain county occupies most of the area north of Township 5 south (extending east and west across the county just north of Broken Bow) with the exception of the territory west of a line extending northwest from Wright City to the Pushmataha county line. Within this range there are several concentration areas (shown on map) scattered over the county, which should be mentioned, for the location of the deer range boundary. The largest concentration areas in the county include the McCurtain county state game preserve, Boktuklo game preserve, and some good deer range around Sam Williams and Hee Mountains. Others are the Carter Mountain area, Lear Mountain, and several areas along Glover creek near the Pushmataha county line.

Six census areas, five of four square miles in size and one of two square miles, were worked. They comprised a total of twenty-two square miles or ninety-six miles of census line in McCurtain county. An examina-

tion of the figures shows the population per square mile varies from an estimated one to fourteen on the McCurtain county state game preserve. By omitting the preserve figures, which represent a typical concentration, the average number of deer for the county is seen to be 2.1 per square mile. Populations on the McCurtain county state game preserve fluctuate a great deal, depending on the season of year, distribution of mast, and movement in and out of the preserve for protection. It appears that deer are attracted to the preserve from points five to eight miles away (tagging work should be initiated to determine this), which would indicate that 600-700 deer utilize the preserve at some times. Local rangers also are of this opinion.

Since there are approximately 1,000 square miles of deer range in McCurtain county, including areas of high populations and those supporting very few or no deer, the best evidence is that there are around 1,800 animals in the county.

LeFLORE COUNTY

The deer range in LeFlore county occupies most of the area south of the north slope of Winding Stair Mountain or south of Township four north to the McCurtain county line. Within this area four areas apparently have more deer than the average range during most of the year. The largest area of concentration in the county is south and southwest of the Kiamichi Lookout Tower which includes the headwaters of Little River and Nochonubbe creek and which extends into Pushmataha county. Three other areas include Cucumber creek (about five miles northwest of Zafra) and the vicinity of Compton. Areas supporting little or no deer include the settlements along the Kiamichi river and around Talihina, extending west into Latimer county. Four deer census areas—two of four square miles in size and two of one square mile in size—which were censused by the U. S. Forest Service in January, 1937, were used in these calculations. This made a total of eight square miles covered by the "cruising method" and two square miles covered by the "man drive" method. In the final calculations a figure of approximately two square miles per deer was figured for the entire county. Since there are approximately 650 square miles of general deer range in this county, the present population is around 400 animals.

PUSHMATAHA COUNTY

The deer range in Pushmataha county occupies most of the territory north of the south tier of townships (adjoining Choctaw county) with the exception of about two townships north and west of Antlers between Eubanks and Jumbo. Two other areas are located in the central part of the county west of Little river and in the northwest part of the county in the Nochonubbe creek region which extends into LeFlore county.

Two deer census areas of four square miles each were censused by the workers. Although both areas were established relatively close together, the reason for this selection was that findings for western McCurtain county should be applied to east central Pushmataha, while the results for southwestern LeFlore would apply to the northwestern section of the county. This made a total of eight square miles covered by the survey party. The census figures show the average number of deer per square mile to be 1.7, although all other evidence indicates this is in excess of actual populations. From all other consideration it appears an average of approximately two square miles per deer would be more nearly correct for the entire deer range. Since there are about 1,160 square miles of general deer range in the county, the total population has been conservatively estimated at 500.

LATIMER COUNTY

Deer range in Latimer county occupies a very irregular area with small spots of good deer conditions which are fairly widely separated. Apparently deer are very low in numbers in the northeastern part of the county and in a large area north and south of Wilburton (45 miles in each direction) and also 10-11 miles east and west of the town. Within this deer range seven areas support the highest populations.

Three areas of particular importance may be found north of Red Oak in the southeast corner of the county, and north of Buffalo Mountain. The area shown on the map along the southern boundary supports few or no deer.

Three deer census areas of four square miles each were censused in this county. On the three areas a total of twelve square miles was covered. The average of the census must be altered to compensate for a larger consideration of poor range than allowed for, which results in an average of

between 2-3 miles per deer. Since there are 430 square miles of general range, the total population has been conservatively estimated at 150 animals.

ATOKA COUNTY

The general deer range of Atoka county includes the northeast quarter of the county with local scattered areas of good and poor condition. In general this range extends from the eastern border of the county at the northeast corner of Township 3 South, Range 14 East, slightly northwest almost to Atoka. From this point it extends northeast into the Pittsburg county line in the vicinity of Reynolds, (northeast corner of Township 4 North, Range 13 East). Within this area five locations were found to be concentration places. Local residents list East Lost Prairie, McGee creek, Redden and Bogy Hollow as good deer areas.

Two deer census areas of four square miles each were selected for census. A total of eight square miles was covered. Final calculations show an average of about two square miles per deer for the entire range. There are approximately 312 square miles of this condition in Atoka county. The population has been conservatively set at 175 animals. No figures are available, however, for the northwest corner of the county.

PITTSBURG COUNTY

Most of the deer range in this county is confined to a small area bordering the county line south of Quinton and Feathers-ton and to a fairly large area in approximately five southern townships. Within the larger range two areas are considered concentration places. They are the Watts Ranch south of Haileyville and the area two miles northwest of Weathers.

From projected figures obtained from other similar conditions, Latimer and Pushmataha counties counts show an average of two square miles per deer, which figure has been applied here. There are about 190 square miles of range, making for a population of around 100 animals.

HASKELL COUNTY

Although Haskell county has been opened to hunting, populations here were found too low for census consideration and hence it is not included in the important deer counties.

SUMMARY OF CENSUS DATA

In Table XVI populations have been summarized by counties, showing a total population for all six counties of 3,125 deer.

Since the total number of square miles of deer range is 3,754, the average number of animals per square mile is seen to be 1.20. However, for most of the range, with the exception of McCurtain county, two square miles per deer is more nearly representative. Higher populations and better range conditions here have been responsible for altering the figure of the remaining southeastern range to almost one square mile per deer.

TABLE XVI
DEER POPULATION IN SOUTHEASTERN
OKLAHOMA

COUNTY	No. Square Miles of Deer Range	Population
Pittsburg	193	100
Latimer	431	150
LcFlore	652	400
Pushmataha	1,161	500
Atoka	312	175
McCurtain	1,005	1,800
TOTAL	3,754	3,125

Average number square miles per deer 1.20

It is important to notice in the subsequent discussion of analysis of open season figures that census figures are reliably substantiated by comparing per cent of take in county distribution to total calculated population percentages by county distribution.

NORTHEASTERN OKLAHOMA

The above discussion roughly includes the deer populations of the Oak Pine Timber Type. Aside from a small area in northwest Atoka county and the southern part in Haskell county, the following discussion concerns northeastern Oklahoma range. At the present time there are three general locations in northeast Oklahoma where deer are fairly evenly distributed. The largest of the three takes in the southern part of Cherokee county, a section of eastern Muskogee, a little strip in the northern portion of Se-

quoyah, and the southwest corner of Adair county. Another area includes the northeast corner of Cherokee, northwest corner of Adair, and a little of Delaware county; while the third includes southeast Adair county and the northeast part of Sequoyah county. No census was made in this range but it has been carefully checked for areas of herd accumulation. It is believed, on good evidence, that deer are increasing here and

ISOLATED RECORDS THROUGHOUT OKLAHOMA

Deer are not uncommon in the rest of Oklahoma where habitat is suitable. Particularly is this true throughout the Post oak Black-jack Game Type and the bottomlands of the major stream courses of the state. However, it is not thought at present that this range figures importantly in the Oklahoma deer picture, even though its poten-



Plate XLVIII—Taking Weights and Beam Diameter Measurement of buck killed in open season. McCurtain county

probably the density per square mile in some sections exceeds that of the Oak-pine range.

Figures from residents, game rangers and others indicate a probable population of around 300 to 350 deer for all of the country east of the Verdigris river and north of the Arkansas, making for a total of approximately 3,500 deer in what is known as the eastern Oklahoma herd.

tial worth must not be underestimated. Nevertheless, it appears that, if the problem of eastern Oklahoma, where ideal deer habitat conditions exist, cannot be solved, there is little need of seriously considering the remaining and more western range on a hunting basis.

Individual ranchers have shown throughout Oklahoma that deer will thrive under only moderate protection even where other

environmental conditions are at a minimum. Areas of more concentrated populations are seen on the accompanying map. In many cases these have resulted from transplanting of both adult and fawn stock. However, in others, the population represents a remnant of the original stock.

TOTAL OKLAHOMA POPULATIONS

It must be realized that any present figure on total number of whitetail deer occupying the state is extremely questionable. No attempt has yet been made to get reliable census figures on all the isolated herds of the state.

In gathering this information so many individuals requested that the figures not be made public, that only the total figure is presented here. From these estimates it appears that there are around 2,000 deer in Oklahoma in addition to those of eastern Oklahoma, making a state total of approximately 5000-7000 animals.

POTENTIAL DEER RANGE IN OKLAHOMA

The accompanying map shows the potential deer range representing the area over which a population should eventually reach such a density as to support an open season year after year. This includes, as is seen, the bulk of the Oak-Pine and Oak-Hickory Game Types. Every square mile is not potential range, but is excluded areas are small and insignificant.

At present in Oklahoma predictions as to the carrying capacity of known deer range are problematical since there has been no opportunity to study areas carrying their limit of deer. However, figures may be submitted based on the carrying capacities of similar range conditions where more information has been gathered. On this basis, average maximum densities between 10 and 20 deer per square mile, varying with local conditions, appear reasonable with a total regional overage of around 12 to 13 deer per square mile. It is important for sportsmen and game administrators to realize that the range at present day use should approach these densities. The requirements of deer are present in that locality. This would figure a conservative population of somewhere near 70,000 deer in these two types alone. It appears reasonable that we might expect more than an average of 10 deer per square mile since Oklahoma deer

do not experience the extreme winter weather found in northern deer range.

ANALYSIS OF DEER SEASON KILL

Since this survey project was initiated there have been two open seasons in Oklahoma. The first was November 11-17, 1939, and the second was November 9-13, 1940. During 1939 six counties were opened: Atoka, Latimer, LeFlore, McCurtain, Pushmataha and Pittsburg, and in 1940 the same six with the addition of Haskell county were opened.

For the first time a deer checking station form was used at all ten of the stations and data on beam diameter and weights collected. When the information collected at the checking stations during the last two seasons is compared with the census results, it is seen that a close relationship exists which further substantiates the usability of such census work as reliable.

DEER KILL RESULTS

During the first open season (1939) 379 legal bucks and five illegal does were killed in the six open counties, and 314 legal bucks and four illegal does were killed during the 1940 season. For use these kills have been summarized by counties. For convenience sake the per cent of total deer populations of the southeast section is listed by counties. It is seen that a close correlation exists between the legal take and calculated populations.

Too, it is seen that, along with similar calculations each season, there is practically no difference between percentage of take as distributed to each county for the two seasons.

HUNTER SUCCESS

The success of hunters in bagging deer varied a great deal between natives, residents and non-residents. However, these variations are about the same for each year. During 1939, 3.91 per cent of the natives killed their deer; 14.9 per cent of the residents and 14.81 per cent of the non-residents were successful; and in 1940, 3.9 per cent of the natives, 11.3 per cent of the residents and 7.1 per cent of the non-residents were successful. The percentages as given are misleading, however, since 5,056 and 5,000 natives; 1,156 and 1,018 residents; and 21 and 28 non-residents were issued hunting permits each of the respective seasons.

It is important to note that 6.08% and 5.17% of the hunters got a deer in each of the successive seasons. This is a strong indication of a low population when compared with success figures in other states. In New Mexico during these same seasons, a hunter success of 33.5 and 32.0 per cent was reported. In Minnesota 50 per cent were successful, and 28 per cent were successful in Michigan. In Table XVII it is seen that native hunters killed most of the deer.

DEER WEIGHTS AND MEASUREMENTS

Deer weights and measurements are extremely important in deer management because they serve as indicators to age and physical condition of the herd. At the checking stations an attempt was made to get as many actual dressed weights (viscera removed) as possible. During the 1939 season only a representative sample of deer was weighed (48 in all) In 1940, 311 deer

TABLE XVII
DEER KILL RECORD BY COUNTIES
1939 SEASON

COUNTY	K I L L E D						TOTAL BUCKS KILLED	
	By Natives		By Residents		By Nonresidents		Number	Percent
	Number	Percent	Number	Percent	Number	Percent		
McCurtain	117	50.64	112	48.48	2	.80	231	61.0
Pushmataha	21	39.62	32	60.37			53	14.0
Atoka	21	61.76	12	35.38	1	2.86	34	8.9
LeFlore	20	62.50	11	34.34	1	5.66	32	8.4
Latimer	9	59.94	8	47.06			17	4.6
Pittsburg	10	83.33	2	16.67			12	3.1
TOTAL	198		117		4		379	

Plus 5 illegal does killed..... 384

1940 SEASON

McCurtain	103	57.2	75	41.6	2	1.2	180	57.3
Pushmataha	34	64.2	19	35.8			53	16.8
Atoka	22	64.7	12	35.3			34	10.8
LeFlore	24	92.3	2	7.7			26	8.3
Latimer	9	60.0	6	40.0			15	4.8
Pittsburg	4	66.7	2	33.3			6	2.0
TOTAL	196		116		2		314	

Plus 4 illegal does killed..... 318

TABLE XVIII
AGE DETERMINATION SUMMARY OF OKLAHOMA DEER

Number	Age-Years	Average Dressed Weight	Antler Points	Per Cent
49	1½	79.7	1-1 to 5-5	45.79
31	2½	109.0	2-2 to 5-5	28.97
22	3½-4½	122.6	3-4 to 5-6	20.56
5	5½ plus	139.8	4-4 to 7-7	4.68

were weighed, and from both calculations the average weight was 106 pounds. Based on average weight, the average deer killed during the past two seasons was **two to two and one-half** years of age. Table XVIII summarized all determination data. Further calculations revealed that 52% of the deer killed, during the 1939 season, weighed under 100 pounds and 48% weighed over 100 pounds. Studies in Pennsylvania have shown a definite relationship between age and weight, and that those weighing 100 pound or less were in the 1½-year age group.

If Pennsylvania whitetail deer (*odocoileus virginianus virginianus*) can be compared with southeastern Oklahoma whitetail deer (*odocoileus virginianus louisianae* or *texanus*) for size, a high per cent of the kill represented in the two seasons' studies is the lower age classes. Calahane's "Beam Diameter Method" and age determination table for Michigan whitetail was applied to Oklahoma in both open seasons. According to the 1939 age data 48% of the kill was 1½ years of age or less, 23% was 2½ years, 18.6% was 3½ to 4½ years of age, and 10.4% was 5½ years or older. Beam diameter measurements on 59 deer in the 1940 season showed the following: 44.7% 1½ years or less; 33.9% 2½ years; and 22% 3½ to 4½ years. Because of the close correlation between age and weight the writers are of the opinion that the Michigan age tables can be generally applied to Oklahoma deer.

FACTORS FOR CONSIDERATION IN A DEER PROGRAM

In Seton's "Lives of Game Animals" George Shiras 3rd is quoted, "It has been scientifically determined that one female whitetail deer and her offspring, in a ten year period, will produce 130 animals, and that two dozen does will have 3,000 descendants in the same period."

From these figures if not from general information of the herd, it is evident that the Oklahoma herd is being held down at some stage. Particularly does this seem important when records of deer take since 1933 are considered.

From analysis of the past six seasons, it is evident that there has been little change in the deer population of southeast Oklahoma during the past ten years. The figures for the last six seasons are as follows:

Year	Number Counties Open to Hunting	Number of Deer Killed
1933	5	235
1935	7	331
1936	7	375
1937	5	347
1939	6	384 (5 illegal)
1940	7	318 (4 illegal)

PUBLIC ATTITUDE

Probably the most important feature in any consideration of a deer program has been the general attitude of the residents of the bulk of the southeastern area toward deer management in general. It has been difficult for the state to get a conviction of violators of the deer law throughout this section. However, there appears to be a recent tendency developing toward a more cooperative attitude of deer lovers. Nevertheless, the value of restoration work south of the Arkansas river in eastern Oklahoma is questionable until some effort is made to guarantee a minimum of poaching.

It would appear, on the basis of information from other states, that in soil areas of low agricultural value, the annual harvest of a deer crop can represent a material value to local people. Open seasons in areas of good deer population result in an additional seasonal income of considerable proportions for cafes, hotels, guides and others.

Results to date in Oklahoma prove that the leaving of fawn deer with such organizations as Boy Scouts, 4-H Clubs, and the like, do much to stimulate a desirable attitude toward deer conservation. Fawns are easily reared and cared for and if a number of sources are available, this method represents a most economical means of introduction. However, fawns should not be taken from any one herd in considerable numbers year after year.

It is believed by the workers that by working with fawns through organizations of the state, much can be done to develop a cooperative spirit toward the proper use of deer and other game.

FIRE

The composition of both food and cover in Oklahoma can be controlled by controlling plant composition. When a fire burns an area, the plant succession is reversed and when land is protected, plant succession advances. In southeastern Oklahoma the survey workers were confronted with the problem of whether or not fires were beneficial to deer in reversing the plant succession

and in affecting other limiting factors as has been found true in other states. The workers, however, arrived at the conclusion that annual burning as now practiced over much of the country causes serious losses from both a game and forest management standpoint. Most of the burning here is done in February and March, which is at a critical time insofar as a deer food supply is concerned. Burning forces deer to concentrate on unburned areas where there is competition between them and livestock.

OVERGRAZING

Overgrazing is a common practice throughout southeastern Oklahoma, being even more destructive here than on the deer range of northeastern Oklahoma. Practically no regulations are prescribed as to the kind or number of livestock a man may place on a tract of land. In addition, due to the open range practice, a person may run livestock at will over any surrounding country. Hence, there is little incentive for range conservation. It was found in southeastern Oklahoma that cows and hogs were most abundant and offered the most serious competition for acorns most utilized by deer. However, where goats are present, they were most destructive to food and cover. Regulations such as enforced by the U. S. Forest Service on western lands should be put into use on all lands owned by State, County and Federal governments in this section.

ROAD BUILDING

Since the highest populations of deer are at present confined to rough mountainous and roadless areas, it appears, on basis of our information, that in general roads introduce factors destructive to deer populations. It would be well for all persons interested in the deer herd to keep informed on future road building projects in this section.

OVERSHOOTING

Age determination studies of this report show that too high percentage of immature bucks are now being taken. Almost half of the total kill of the last two seasons was composed of bucks of 1½ years of age or less. On this basis alone any open season involving some 5,000 legal hunters looking for some 3,000 deer constitutes overshooting. Further, there is much local opinion throughout this section that the illegal take is responsible for not only the scarcity of mature bucks, but for the high take of young bucks in the open season. With a deer herd so

small as this one, it is highly reasonable that the illegal take alone is the major factor in keeping the population underdeveloped.

ADJUST DEER SEASON

It is the opinion of the workers that better breeding results would come about if the shooting season on deer was so situated that the hunting did not cut into the peak of the rutting season. It appears that a date from the end of November or the first part of December would be better.

DISEASE

Although no data were gathered during the survey regarding the importance of disease as a limiting factor, the findings in Texas should be mentioned since they may apply to Oklahoma in certain sections. Texas investigations shows that summer is a critical period for their deer because of the screw worm infection. Ticks and their effect on deer is in need of some study, too, in Oklahoma.

POACHING

Poaching is a major problem throughout Oklahoma deer range, and becomes particularly serious where local courts fail to cooperate with law enforcement agents. It is believed by the survey workers, as well as by rangers and sportsmen in this section, that poaching is the greatest single factor operating toward a low deer herd in eastern Oklahoma.

PREDATORS

Predation of adults does not appear to present a problem of any seriousness in Oklahoma. However, the take of fawns appears to be locally serious. More investigation is needed on this phase of work in Oklahoma.

ESTABLISHMENT OF REFUGES

Generally considered and, insofar as deer are concerned, the results obtained from the McCurtain county state game preserve have been highly successful. It is the opinion of the workers that this preserve is responsible for the majority of deer that are present in McCurtain county today. All known data pertaining to open seasons, with records and census figures, point this out. It would be desirable to set up other such preserves throughout the deer country. There should be not less than one in

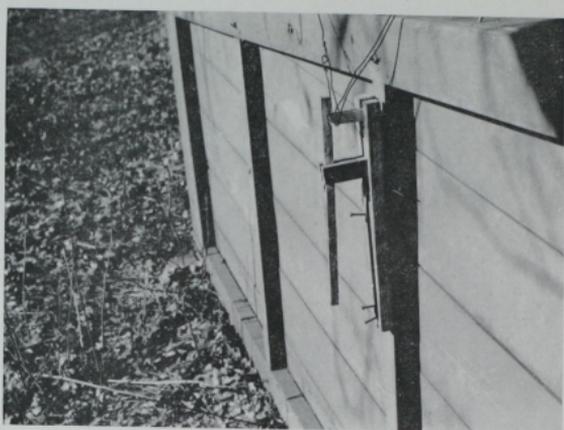


Plate XLIX—View of "rabbit trap" type of trigger on deer traps.

western McCurtain county, one in Pushmataha county, and one in LeFlore county, plus at least two more in the northeastern Oak-hickory condition. Each preserve should be fenced and patrolled. One of the principal reasons why the Boktuklo preserve is not functioning satisfactorily is because it is not fenced.

THE PRESENT DEER PROGRAM

The Division of Wildlife Restoration began its present deer program in July, 1942, basing its action largely on the results of the deer survey. Despite serious cut in personnel and materials, due to the war emergency, a beginning has been made. A project was set up and approved to move adult

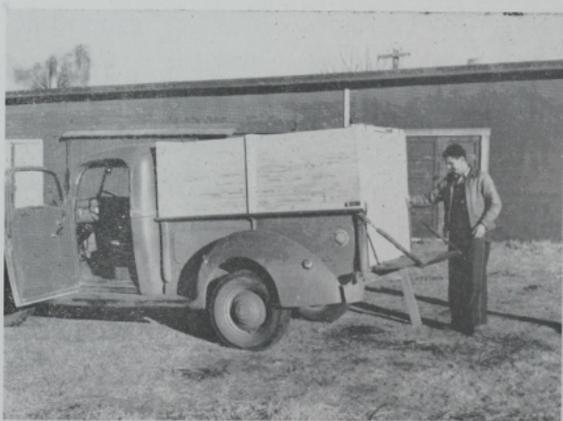


Plate L—Carrying crate used for transporting deer from trapping area to release area.



Plate LI—Showing front end of baited deer trap.

and fawn deer from areas of concentration to areas lacking breeding stock but having suitable habitat. Due to the willingness with which cooperation was offered by the people of northeastern Oklahoma, it has been decided to concentrate the efforts of the remaining personnel in building up a suitable stock for breeding purposes in the Oak-hickory forest section.

Through the past two winter seasons, 1942-43 and 1943-44, better than 75 adult deer were bait trapped and moved to selected areas in northeast Oklahoma. The Pisgah National Forest Trap was used for most of this work and proved fairly satisfactory under Oklahoma conditions. The cost of trapping was \$26.48 per deer, which is economical. However, experiments are

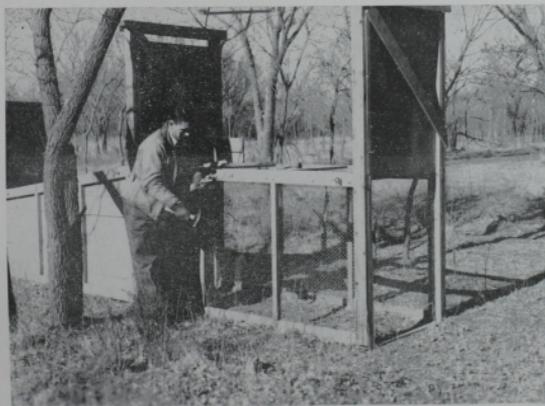


Plate LII—The Pisgah National Forest style deer trap used in restocking work.



Plate LIII—Releasing adult deer on project area, Northeast Oklahoma.

under way in 1943 to reduce this cost by use of other methods.

During the spring of 1943 an arrangement was made to pay \$5.00 per head for fawns turned over to the workers from areas of concentration. Through this method 13 fawns were turned over to local organizations and individuals in northeastern Oklahoma to be

reared to an age at which they may be safely released in the wild.

Also under way is a program for acquiring land to be used for preserves throughout the eastern deer country. It is contemplated to develop not less than five additional areas similar in size and function to the one existing at present in McCurtain county.

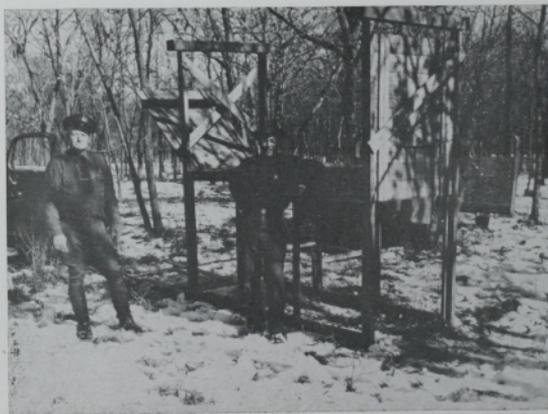
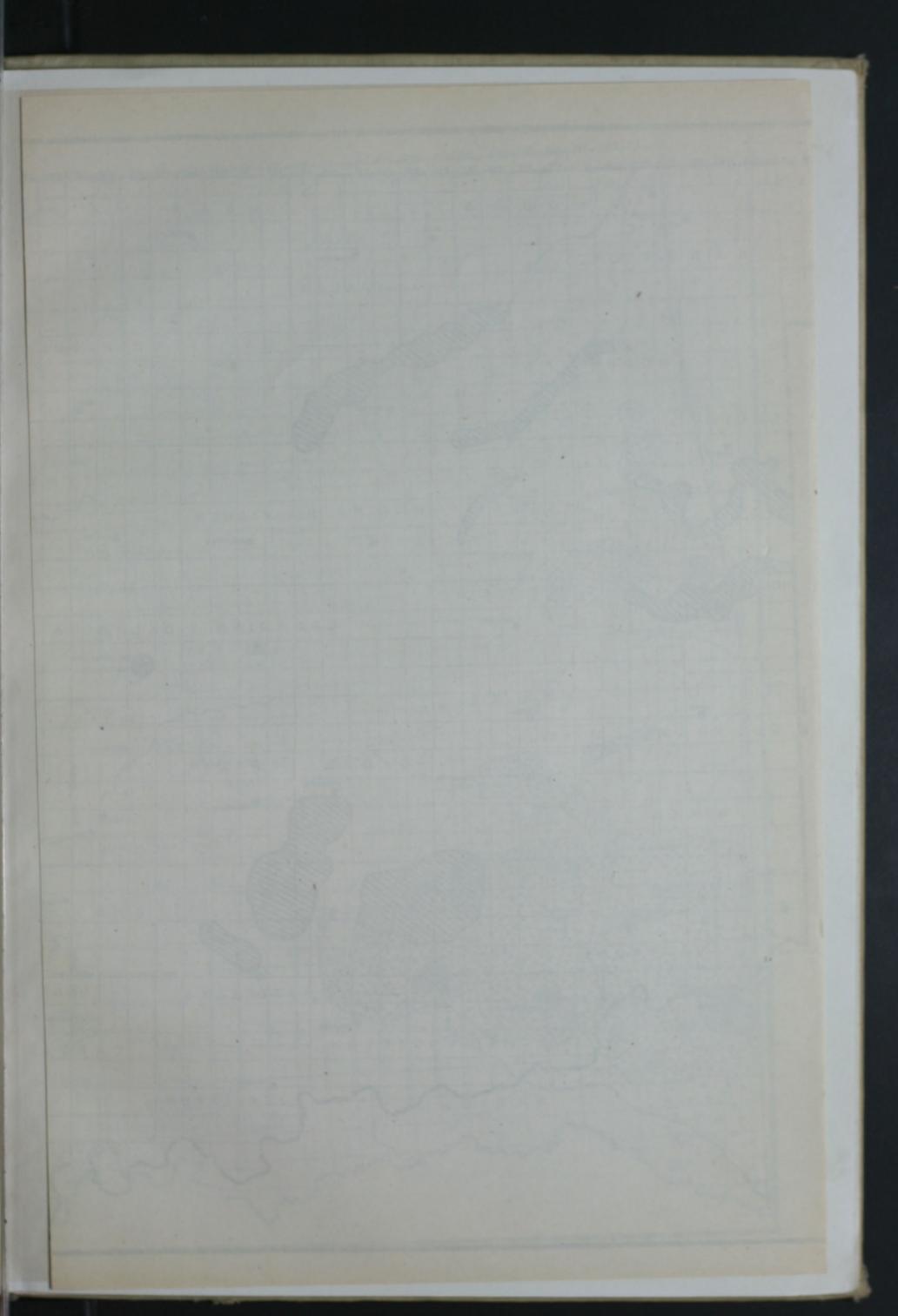
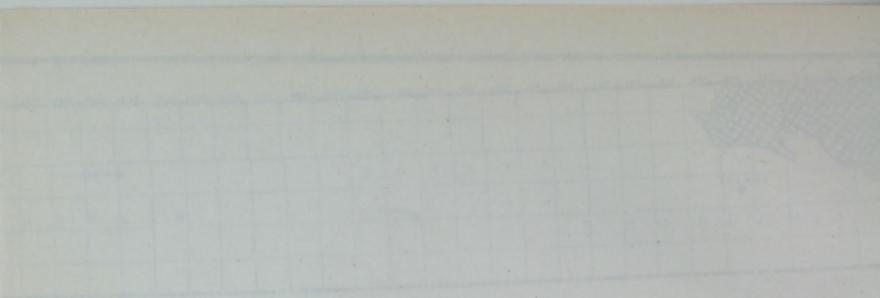


Plate LIV—One style of deer trap used in capture of adult stock for transplanting.





DEER POPULATIONS, RANGE
& DENSITIES IN OKLAHOMA

SEASON
1940-41

AREA OF HIGHEST POPULATION OF WHITE-TAIL DEER
 DEEPER RANGE OF WHITE-TAIL DEER
 AREA OF EXCELLENT POTENTIAL RANGE FOR OCCUPATION BY WHITE-TAIL DEER
 AREA WITH LOW DENS. SOME BULLS FROM PLANTING WHITE-TAIL DEER
 NORTH MOUNTAIN WOLF DEER RANGE



Plate LV.—Feeding fawns on bottle. These fawns are used to restock Oklahoma's deer range.

CHAPTER XII.

SQUIRRELS

The Gray Squirrel (*Sciurus carolinensis* Gmelin)

The Fox Squirrel (*Sciurus niger rufiventer*)

Fox and gray squirrels occupy the same districts throughout most of their ranges, but often become so segregated locally that the grays may be found almost exclusively along bottomlands and the fox squirrel on the higher ridges, but there is no hard and fast separations of haunts and the two forms usually share the same woodlands.

FORMER DISTRIBUTION AND ABUNDANCE

Gray squirrel were formerly along all the major streams supporting a bottomland forest with tall dense, heavy growths of timber, and in the Post-oak Black-jack Timber Type where the desired timber situation was found. From all records on its distribution, it appears that a line drawn north and south through Oklahoma City would mark the western boundary of this squirrel's range. Little information is available on the past numbers of this species, but apparently there was an abundance of them.

The fox squirrels were formerly found throughout Oklahoma wherever there was enough timber to support them. Although they were not found in great numbers in the gray squirrel range (dense, tall timbered areas), they were usually near by or around the edges. As in the case of the gray squirrel, no information as to actual numbers in the past is known, except that they were "plentiful".

PRESENT DISTRIBUTION AND ABUNDANCE

The gray squirrel is still well distributed over its former range, but the area of its range has been greatly reduced. The broad, rich bottomlands of eastern Oklahoma which formerly supported such high populations, have since been cleared for farming and lumbering. As a result, the present range is being continually reduced.

The bottomland food and cover type supports a high population, especially in the western portion of region. The area of the

present range has been reduced greatly from its former status by intensive land use practices. The method of logging and clearing of sub-marginal land for agricultural use has reduced the range and destroyed a high per cent of the den and food supplying trees necessary for a high squirrel population.

For the open season of 1941 both species were "plentiful". Most of the hunters in the bottomland food and cover type had little difficulty in finding a successful day's hunt, with or without killing the legal limit of ten squirrels.

CENSUS METHODS AND RESULTS

Because of the dense vegetative growth at the time the census was attempted, the Texas "Time-area Count" was found unsatisfactory. For the gray squirrel a still-hunting procedure was devised. In this method, a distance was paced using the same care in stalking as a still hunter, and the squirrel observed were tallied. The distance from the line of transect to the spot where the squirrel was seen was measured. The farthest distance from the line of transect was assumed to be one-half the width of the transect and the distance paced as the length and from these dimensions the acreage of the sample area was computed. Due to the short time allowed for the survey and the relatively few counts made, the information was not considered sufficient to base a population figure on. The information derived from these sample areas is contained in Table I.

Although about six weeks was spent on squirrel survey work, very little was accomplished in censusing the fox squirrel. The time-area and cruising methods used on the gray squirrel were of little value on the fox squirrel in making total counts. The leaf-nest count method also was of no value. A special study of the squirrel was carried out in Mohawk Park, Tulsa, as discussed later, in which no correlation between leaf-nest counts and actual populations was found.

For the other methods it was found that such a large sample area was required that it was impracticable for the limited field force to attempt to cover the entire region. It was found that the only method that offered any degree of success was the use of a squirrel dog.

FACTORS AFFECTING ABUNDANCE FIRE

Fire is certainly to be considered as a factor in squirrel limitation. Any fire in the forest destroys standing dead timber, which supplies den sites for both species. Dead, standing timber with suitable hollows is absolutely necessary in squirrel habitat. Since the fox squirrel is more of an upland species, they are probably more seriously affected than the gray, whose habitat is not so subject to burning. In either case, however, any fire is destructive and should be prevented.

ACCIDENTS

To normal, healthy squirrels fatal accidents seldom occur. There are records of individuals being killed by falls from trees, but the squirrel often falls from considerable heights without injury. One of the workers witnessed the killing of an adult female and three young (fox) squirrels when lightning struck a den tree. How often such accidents occur in nature is not known, but apparently they are not a serious limiting or reducing factor.

POACHING

This is a factor affecting every game species in Oklahoma. There is little excuse for poaching in the case of the squirrel. The long open season (7½ months) should give the hunter every opportunity to satisfy his hunting desire. However, many squirrels are killed in January and February, and some are killed in the remaining closed months. In spite of this illegal killing and long open season, the squirrel has maintained itself very well, but with the constant decrease of desirable habitat, more stringent enforcement of laws and a shorter season must be imposed.

PREDATORS

Among the mammal and bird enemies of the squirrel are the rattlesnake, chicken snake, coach whip snake, Cooper's hawk, marsh hawk, barred owl, gray fox, bobcat, and feral house cat. Red shouldered hawks and barred owls are very abundant in squirrel territory and probably are the principal predators, but no evidence is available to prove this.

While general observations indicate that predation upon squirrels in the wild is not serious, it is obvious that good cover in the form of tree cavities, nests, leaves, and vines

is a prerequisite to protection. The destruction of squirrel habitat opens the way for predators.

GRAZING

Excessive grazing prevents the reproduction of certain species of plants that are valuable as food and cover for squirrels. On the other hand, moderate grazing by cattle and horses seems to do little harm and may even be favorable. Squirrels tend to do more feeding when the herbaceous cover is not too dense. Hogs compete directly with squirrels for mast, particularly for pecans, hickory nuts and acorns.

DROUTH

Drouths decrease the amount of available free water in streams, ponds and lakes, causing squirrels to concentrate in small areas where they can secure water. There they become much more vulnerable to attacks by man and natural enemies than would otherwise be the case. Squirrels require water in abundance, and a drouth may at times become a serious limiting factor.

FOOD AND COVER

Generally the gray squirrel prefers a dense tall stand of timber with many hanging vines and leafy branches for his habitat. The fox squirrel prefers a more open stand and spends more time on the ground. The fox squirrel will and does invade the gray squirrel range, especially after logging operations by man. Trees with suitable cavities and hollows for dens are essential for both species.

Both squirrels build summer leaf nests, the fox squirrel usually building much higher in the tree than the gray. The gray squirrel builds two type of nests, similar in appearance, but one type is against the body of the tree and the second far out in the branches. The first is used to bring off the summer litter and the second for resting and loafing.

The greatest enemy of the squirrel is the axeman and his destruction of habitat. The importance of stopping the cutting of dead and hollow trees cannot be overemphasized. This is the greatest single factor now reducing the squirrel population in Oklahoma.

Both the fox and gray squirrel eat a wide variety of foods and their appetites are guided by the kind of food available at any particular season. Some of the most common

foods found in Oklahoma are hickory nuts, pecans, walnuts, acorns (bitter and sweet), basswood, berries, blackberries, huckleberries, Osage orange, the seeds of elm, maple and ash, plus wild cherries, corn, roots, tubers, buds, twigs and bark. Like most other small rodents, they are fond of larvae and insects and also destroy many birds' nests and young birds.

Food shortages in specific localities will cause the gray squirrel to move (locally called "migrations"), sometimes for great distances. In past years many such movements have been recorded, and in August, 1941, a small movement was reported in northeast Atoka county. The gray squirrels came from the southeast and were moving northwest across a wide pecan bottom on North Boggy River. The observer estimated "several hundred" and killed many of them. Apparently this was not a large nor long movement as only one observer reported it.

MANAGEMENT SUGGESTIONS

1. Destruction of favorable habitat has been the primary factor in squirrel decrease. Lack of proper regard for biological principles in harvesting forest trees either has reduced the quantity of squirrel habitat or, in some cases, completely destroyed it. A reversal of these practices, even in part, will help to restore the squirrel in many sections.

2. At present the permitted open season conflicts with the breeding periods of the squirrels and so results in losses out of all proportion to the actual hunting done. Our studies show that the principal crop of young squirrels occurs in the early spring, and there is a second little brought off in the late summer, while in some cases breeding occurs throughout the year. Therefore, two closed seasons are recommended for the period December 15-May 15 and July 1-October 15, in order to permit reproduction with the least interference from hunters.

3. Small woodlots and timbered areas can be greatly improved for squirrel production by artificial means. This would include the putting up of artificial dens made from hollow logs and limbs, and box nests. In areas of high concentration the planting of food patches will tend to hold the population on that area. This type of conservation work should appeal to Boy Scouts, 4 H Club boys, Junior Izaak Walton League members, and park employees desiring to carry out wildlife programs on their particular areas. A supply of nest material (excelsior) will at-

tract gray squirrels to areas deficient in den trees. Squirrels will make use of this material for both winter and summer nests.

4. Release cutting to favor the growth of hickories, oaks, walnuts and other food trees will increase the yield of squirrel foods. This operation consists of clearing out undesirable trees which compete with valuable food producing species.

5. Compulsory hunters' reports should be required to obtain an inventory of the squirrel (as well as for all other game species) harvest.

6. It is recommended that the present daily bag limit of ten squirrels be reduced to six and the seasonal limit of fifty be reduced to thirty-five. This is made necessary by the continuous decrease of suitable habitat and the consequent possibility of decimation of the species.

SQUIRREL SURVEY OF MOHAWK PARK

A general squirrel survey carried on over the entire eastern one-half of Oklahoma was for the purpose of getting distribution of both fox and gray squirrel and trying out census methods. Due to the fact that the squirrel survey work for eastern Oklahoma was of a preliminary nature, it was thought advisable to make a more detailed survey of Mohawk Park in Tulsa county.

This area was selected for this study because of the high concentration of squirrels and the splendid cooperation offered and given by the Mohawk Park employees. The workers spent approximately two and one-half weeks during June and July on the park.

Mohawk Park lies six miles northeast of Tulsa, Oklahoma, and is the Tulsa Municipal Park. The park covers an area of 2,800 acres, of which 1,440 are in woodland, 760 acres in open fields and water, 600 acres in open golf course and meadows.

The area is particularly suited for squirrel census work, being somewhat open and heavily timbered with old (70-80 year) timber, flood plain food and cover type. Dominant trees are of the Black Oak group, and trees and shrubs native to the area include (*Quercus rubra*, *Quercus palustris*, *Quercus velutina*, *Quercus nigra*, *Quercus phellos*, *Quercus macrocarpa*, *Quercus prinus*, several Elms (*Ulmus spp.*), several Hackberries (*Celtis spp.*), Mulberry (*Morus sp.*), several Hawthorns (*Crataegus spp.*), and Maples (*Acer spp.*). Other than the oaks, the most

important food producing tree is the hickory (*Carya spp.*).

Over a large portion of the area the understory has been cleared to a certain extent making the area open to the public. The entire area is primarily a public park and recreation grounds. However, part of the park has been set aside as a wilderness area, left in its original condition, and the public barred from it. This wilderness area is heavily forested and has a dense understory of brush, shrubs, weed, gensebriar, blackberries, grape vines (*Vitis spp.*), and other desirable plant growth. The entire area is protected from hunting and this protection is rigidly enforced. The squirrels in this area have not been molested by man and absolutely normal conditions exist.

Over part of the area squirrels have become acquainted with and tolerate man, in some individual cases becoming almost tame. No artificial propagation is practiced and population fluctuations are allowed to occur normally. According to Hugh S. Davis, director, Mohawk Park Zoological Garden and Park Conservationist, the squirrel population is cyclic, reaching its peak about every seven years. From all sources of information, it appears that this year (1941) is near the peak of the cycle. It will prove profitable to watch this area closely for the next few years.

INVENTORY METHODS

The writers made both Time Area Counts and Leaf Nest Counts on the Mohawk Park. Time Area Counts are made by taking sample plots over the entire area and counting the number of squirrels in sight on a particular sample in a definite period of time. The distance from the observer to the squirrel the greatest distance from the observer was used as the measuring stick for determining the total area of the sample. The Leaf Nest Counts were made by taking a sample of a definite size and counting every nest that looked as if it was being used or had recently been used. No old nests were counted. The data taken by each method is summarized in Tables I and II. From the work done in Texas and Ohio, the writers thought there would be a close correlation between the two methods, but from the findings on this park there was no relation.

POPULATION FINDINGS

An analysis of Table XIX (Time Area Count) shows a population of 3.2 squirrels (both fox and gray squirrels) per acre, which is probably nearly correct. Although a total

figure is often of little value, it is often used in making comparisons. Therefore, a total figure is given for Mohawk Park (1,440 acres of squirrel woods times 3.2 squirrels per acre, equal 4,508 squirrels for the Park), 4,508 squirrels. Further analysis of Table I shows approximately two thirds of the total population to be gray squirrels and one-third to be fox squirrels. In other words, for sake of a figure, there are approximately 3,005 gray squirrels and 1,508 fox squirrels on the Mohawk Park area. However, as far as future work is concerned, the squirrel per acre will be used in making population comparisons from year to year.

When Table XX (Leaf Nest Count) is analyzed it shows a total of fourteen nests per acre. These were nests that looked like they were being used at the time the count was made; all old nests and partially constructed nests were omitted. Using Goodrum's Texas Tables of two gray and one fox squirrel per nest, an aggregate of 9.3 squirrels per acre is derived. This is, in the writers opinion, an impossibly high concentration and is far from a true indication of numbers. One of the writers had under his observation during the summer and autumn of 1940 a large number of fox squirrels and observed one pair build five nests in one walnut tree. Over the entire area the squirrels built nests far out of proportion to their numbers. With this information at hand and the data included in Tables I and II, the writers think that leaf nest counts may be taken as indicative of the relative abundance or scarcity of squirrel in a given area, but apparently are not true indicators of numbers.

LEAF NEST INVESTIGATION

Because of the present squirrel season in Oklahoma, the workers attempted to prove that there is a second breeding season among the gray squirrels. In order to establish this fact here in Oklahoma, the workers climbed 35 trees and investigated 35 nests—mostly gray squirrel nests. Three litters were found with three, three and one to a litter respectively. This is an average of one litter per acre. It appears that July 15 is about the peak of the second season. From the writer's personal observations and the information at hand, it appears that this second season is of only minor importance as compared with the spring breeding season. However, no definite data have been taken to prove this point. In the view of these findings, some changes should be made in the present law.

TABLE XIX
TIME-AREA COUNTS ON MOHAWK PARK,
TULSA COUNTY

Area No.		Squirrels Seen	Gray	Fox
1	1.89	5	5	0
2	.62	4		4
3	1.71	7	5	2
4	1.60	4	4	0
5	1.01	3	0	3
6	.31	2	2	
7	.61	3	3	
8	.52	2	2	
9	1.32	9	7	2
10	.61	11	9	2
11	1.01	7	4	3
12	1.73	4	4	
13	1.80	5	1	4
14	1.90	5	2	3
15	1.01	6	3	3
16	.89	4	4	
17	1.15	5	3	2
18	1.60	4		4
19	1.00	2		2
20	1.70	3	1	2
21	1.60	3	3	
22	1.3	6	5	1
23	3.25	11	8	3
24	2.5	6	6	
25	1.25	1	1	
26	1.25	6	4	2
27	1.0	5	5	
28	4.375	7	6	1
29	2.5	3		3
30	1.7	1		1
Total	44.725	144	97	47

Density of 3.2 squirrels per acre.

TABLE XX
LEAF-NEST COUNTS ON MOHAWK PARK,
TULSA COUNTY

Area No.	Acreage	Nests Observed
1	.52	4
2	.52	4
3	.52	6
4	.52	3
5	.52	4
6	.52	3
7	.52	3
8	.52	12
9	.52	12
10	.52	19
11	.52	6
12	.52	7
13	.52	21
14	.52	3
15	.52	13
16	.52	1
17	.52	9
18	.52	2
19	.52	6
20	.52	10
21	.52	7
22	.52	21
23	.52	0
24	.52	4
25	.52	2
Total	13.00	182

Nest Density of 14 nests per acre.



Plate LVI—Young gray squirrels in a leaf nest. Middle of July.

CHAPTER XIII.

THE RABBITS OF OKLAHOMA
INTRODUCTION

According to Blair (1939) there are five different kinds of rabbit in Oklahoma. These are the Black Tailed Jackrabbit (*Lepus californicus melanotis*), Eastern Cottontail (*Sylvilagus floridanus alacer*), Western Cottontail (*Sylvilagus floridanus llanensis*), the New Mexico Cottontail (*Sylvilagus audubonii neomexicanus*), and the Swamp Rabbit (*Sylvilagus aquaticus aquaticus*).

DISTRIBUTION
JACKRABBIT

The jackrabbit is typically a plains animal, being adapted both physically and by instinct for life in the open. In Oklahoma the highest populations are on the western open grasslands and shrubby uplands. Unlike the cottontail here, it is more frequently seen on the uplands away from wooded streams. Eastward the animal diminishes in numbers, yet may be considered as abundant over all the major game types with exception of the Oak-pine and Oak-hickory forest type. They are somewhat rarely seen in the southeastern Oak-pine forests, being

scattered generally through the northeastern Oak-hickory condition.

COTTONTAIL

One form or another of the cottontail rabbit is found throughout Oklahoma, and generally abundantly represented.

The eastern cottontail is reported by Blair (1931) to range over the eastern half, while the western cottontail occupies the western half, with apparently much overlapping of range and characteristics. These are the common cottontails so well known in Oklahoma.

The New Mexico cottontail is easily distinguished from the common cottontail. It is found on certain soil conditions probably as far east as the western one-third of Oklahoma, but more commonly throughout the panhandle and western edge of the state. This species is generally found in prairie dog towns, where it is a burrow living animal. This or a similar close related form (*Sylvilagus audubonii baileyi*) is found throughout the rock crevices of the mesa country of the Pinon-juniper-mesa game type.

TABLE XXI
CENSUS FIGURES FOR COTTONTAIL RABBIT
FALL OF 1940

LOCATION	TYPE	Acres Per Rabbit
Western Wood county	Sand Sage	2.6
NE Alfalfa county	Sand Sage	16.0
	Average.....	9.3
SE Woods county	Stabilized Dunes	1.9
NE Major county	Stabilized-Dunes	1.5
NE Major county	Stabilized-Dunes	1.0
	Average.....	1.4
NE Major county	Post-Oak-Blackjack	3.8
E Logan county	Post-Oak-Blackjack	4.2
Central Logan	Post-Oak-Blackjack	12.0
North Logan county	Post-Oak-Blackjack	18.1
E Blaine county	Post-Oak-Blackjack	4.9
E Dewey county	Post-Oak-Blackjack	4.8
	Average.....	7.9
E Oklahoma county	Post-Oak-Blackjack	3.0
NE Oklahoma county	Oak Hickory	4.0
NE Oklahoma county	Bottomland	2.0
SE Oklahoma county	Oak-Pine	10.0 rabbits per square mile in Upland Forest.

The swamp rabbit is found in some numbers, (never numerous), along most of the streams and in low marshy places in eastern Oklahoma and has been reported westward about the central portions of the state, particularly along the southern one-third north of Red River.

DENSITIES

During census work with various species it was often possible to get some figures on the densities of rabbit populations. Cottontail figures are available to present a fairly good statewide picture. However, jackrabbit was counted only in northwestern Oklahoma.

It is interesting to note the fairly high cottontail populations shown for six game types studied. In some cases these approximate quail densities for the same areas, and in others, rabbit exceeds quail in numbers. However, there is much similarity in the quality of habitat which favors both cottontail and bobwhite. The absence of fields and openings within the particular area representing the Oak-Pine Type accounts for the low rabbit population given. Agriculture and lumbering throughout the eastern wooded section are responsible for excellent rabbit habitat.

Jackrabbit counts here are from western Oklahoma.

TABLE XXII

CENSUS FIGURES FOR JACKRABBIT IN WESTERN OKLAHOMA—FALL OF 1940

GAME TYPE	Acres Per Rabbit
Sand-Sage Type	10.2
Stabilized Dune	5.9
Post Oak-Blackjack	26.9

Unfortunately figures are not available for the areas of western upland supporting higher jackrabbit populations.

No figures are available for either swamp rabbit or the New Mexico cottontail. However, observations on the occurrence of the latter, particularly in northwestern Cimarron county, show definite fluctuations in numbers of considerable magnitude. During the fall of 1939, the rabbit was abundant throughout the Pinon-juniper condition, it being an easy matter to shoot a dozen or so specimens a day. During the fall of 1940, however, the workers had difficulty even securing single specimens for study.

STATEWIDE CHARACTERISTICS

All three forms of the cottontail rabbit appear to fluctuate considerably over periods of several years. While the cause of this is not definitely known, some interesting things do seem to be associated with the upward and downward movement. In western Oklahoma a peak in rabbit populations was reached during the fall of 1939, which, incidentally, was a peak in bobwhite populations. Post mortem of rabbits showed extremely heavy infestation by tapeworm during this period, and a number of rabbits were found to have crowded under dense brush and died. These showed no outward sign of injury and were all sufficiently decomposed internally as to make a diagnosis questionable as to cause. Associated with these two conditions, one of which was heavy tapeworm infestation, and the other which appeared to be some disease, was the occurrence of an extremely severe late winter storm. A food shortage was indicated at this time by severe girdling of all shrubbery available. The next year (1940) showed an extremely low cottontail population in all sections which had supported such an abundance the year before.

Data are not organized on this matter of fluctuation on a statewide basis to do more than simply cite such cases. Conclusive treatments are not now possible.

VALUE OF RABBITS

Rabbits are not legal game in Oklahoma, probably because of the relative abundance of more desirable game animals, such as bobwhite. It is not likely that legislation toward making even cottontails legal game would succeed in Oklahoma, since, in most rural sections, particularly where berries or trees are grown, these animals are among the important farm pests. Rabbit damage to green growing plants also runs into important crop loss during some years. Yet cottontails in some states are important game species and popularizing them with the sportsmen in Oklahoma would aid in controlling them in farm areas. Wide publicity against using rabbits for food on account of the dangers of Tularemia or rabbit fever has done much to discourage the use of the flesh as meat in areas where it formerly formed an important part of the winter and spring meat supply.

Probably the recent trend of the use of beagles in certain sections of Oklahoma will help Oklahoma to realize the value of cottontails as food and sport.

CHAPTER XIV.

MISCELLANEOUS SPECIES

ELK

Elk apparently were once abundantly represented in Oklahoma. The last record we have is that of Bandel, 1857, for the Salt Plains in Alfalfa county. Bennett (1937) says: "Elk were abundant in all parts of the state except the open prairie until the 1830's." This indicates they inhabited the forested regions. The records of Oklahoma seem to show that they persisted on the Tall Grass Prairie in conjunction with heavily timbered stream bottoms. They were recorded from 1719-1857 at various dates in Pittsburg, McIntosh counties, on Red river, Blue river, the Cherokee prairie in northeast Oklahoma, Bridgeport on the South Canadian, on the Arkansas river in Tulsa county, Pawnee county, Salt Fork of the Cimarron, in the Wichita Mountains, in Greer, Kiowa and Comanche counties.

ANTELOPE

Records are available from 1870 to the present date. They were recorded in the Wichita Mountains, Little Washita river, Caddo and Comanche county, Major county, northeast Cimarron county, Wood and Harper counties, Arkansas and Verdigris rivers, Sweetwater creek in Roger Mills county, Greer and Kiowa counties, Garvin county, Custer county, McIntosh county, Grand and Kay counties, along the Red river, Little river in Cleveland county, near Bartlesville, mouth of the Canadian river, Bridgeport. The antelope disappeared westward with the movement of settlers. They were gone from western Harper county by 1910, about the

same time in Beaver county. This seems to be about the date of their disappearance through Beckham county where the last dates are around 1900 to 1908. In Jefferson county our last record is 1890. There are still approximately thirty antelope on the ranchland northeast of Boise City in Cimarron county where they have survived due to the rigid protection given by local ranchers.

It is possible that Oklahoma may reintroduce antelope into some of the ranchland of Roger Mills, Beckham, Ellis and Texas counties. However, it is not likely that hunting of this species will ever again be enjoyed in Oklahoma.

BUFFALO

Records indicate that Buffalo were gone from Oklahoma by 1885 with the possible exception of a few scattered animals through the panhandle. It seems they were gone from Tillman county by 1878 and from Beckham county by 1885. Records are available from every section of the state, showing buffalo to have been abundant at the time the first explorers came. It is interesting to note that when buffalo, or any other species, become scarce, people reported that they had moved west. This idea still persists with people along our state boundary. Buffalo today are confined to a few private ranches and park areas. There is no place in modern land use for this once abundant animal.

PECCARY

In 1850 peccary were recorded as abundant along streams between Neosho and Arkansas rivers.

CHAPTER XV.

THE FUR BEARERS

INTRODUCTION

The fur trade has never figured among the important industries of the state. Even during the pre-settlement days it appears the trappers crossed Oklahoma but seldom stopped before reaching the higher country of the Rocky Mountains. However, for a brief span of years, traders did considerable business in deer and buffalo skins. Accounts are available noting huge piles of baled deer hides at various trading posts, awaiting shipment to eastern markets. The great slaughter of buffalo began in 1871 and although most of the hides were accumulated at railroad points in Kansas and Texas, much hunting and trading was done in what is now Oklahoma. This period of fur trade was brief, however, and by 1878 buffalo were largely gone from the Oklahoma area. During the years from 1871 to 1874 buffalo killing was the principal occupation on the plains. Thousands were slaughtered for their tongues alone. Figures show that during 1873 the Atchison, Topeka, and Santa Fe Railroad carried out 25,743 buffalo robes, 1,617,600 pounds of meat, and 2,743,100 pounds of bones. Robes were said to represent about 1 in every 3 buffalo killed.

Other than deer and buffalo, such species as bear, otter and mink are infrequently mentioned as being taken for fur. Apparently, no important trade in these furs ever developed. Wolf trapping and poisoning enjoyed a brief period of activity in this section being fairly closely associated with buffalo hunting.

The fur trade in Oklahoma developed with settlement and served as a source of income incidental to the regular farm income, as such is the case today. There are but few professional trappers in the state today. The bulk of the trapping is done by farm boys and adults of low income groups, as a means of incidental income, and often does represent an important seasonal factor in the livelihood of these people. A good many raccoon, fox and coyote, taken mainly for sport, find their way to the market.

In the following an attempt is made to analyze the fur trade as a business rather than on the basis of the ecology of separate species. Fortunately, a reasonably accurate

analysis as to its size is available from the fur dealer records which have been worked in detail since the 1938-39 trapping season. The report to follow is based almost entirely on these figures.

TRENDS IN THE FUR TRADE
LICENSE SALES

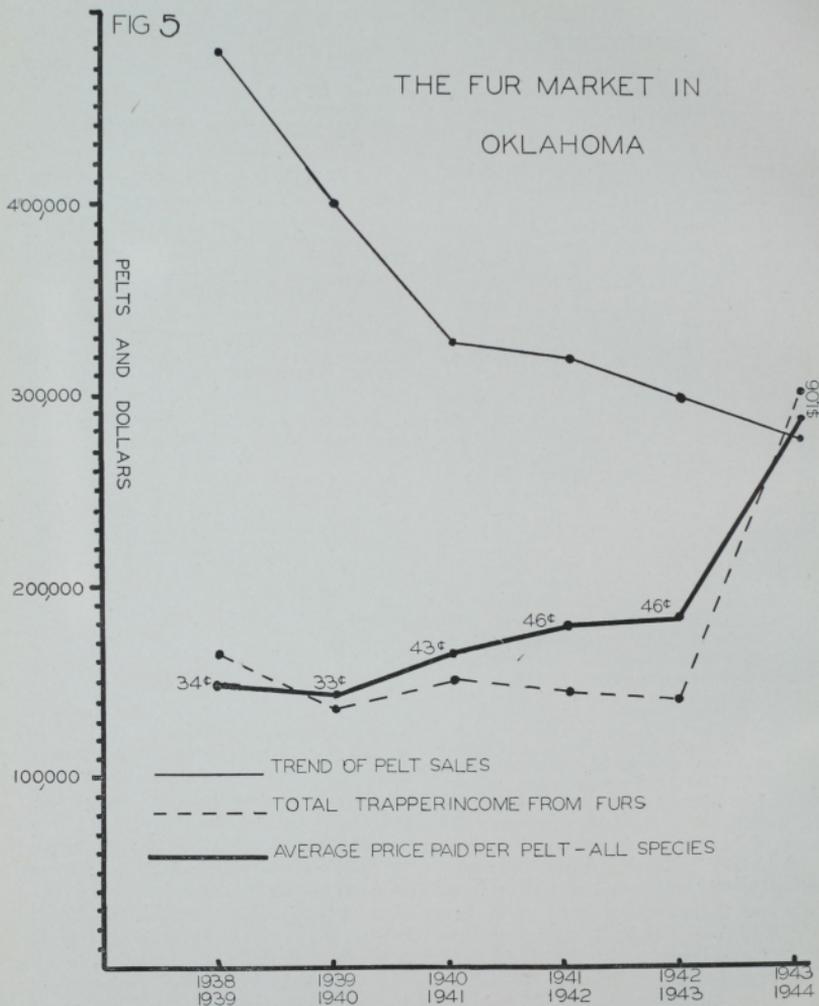
Examination of the following table shows the tendencies of the fur trade to react to the general economic conditions. The trends shown by the number of dealer licenses sold is believed to be more reliable in a specific year than the number of trapper licenses, since the latter are not subject to such probabilities of control as are the former. Most dealers are forced by their condition of operation to buy a license, while trappers may more or less easily evade the license tax.

Records are available showing the revenue received by the Oklahoma Game and Fish Commission since July 1, 1930 to June 30, 1942. From the figures in Table XXIII, it is seen that dealer license revenue as well as trapper license revenue has rather steadily declined since 1930. Explanation of the material drop in revenue from trappers license sales from the fiscal year of 1930-31 of \$5,631.00 to \$3,605.00 for the season of 1931-32 is in the decision of the Attorney General that trappers operating on their own land were not required to purchase a license. However, this does in no way explain the rather uneventful decline in revenue received from dealers licenses from 1930 to 1942. It has been generally held by the state game officials that the reduction in dealers license cost from \$25.00 to \$15.00 allowed for a greater total revenue, since it allowed many smaller buyers to participate. However, it is important to note that the Department's figures do not bear this out. In fact, the reverse seems to be true. Revenue from this source dropped nearly \$2,000.00 when the cost of licenses were reduced. In fact, there is good argument to show that the fur industry as a whole would benefit by the elimination of the small inadequately financed buyer.

Generally the figures of this section show that revenue is steadily decreasing from the fur industry of the state.

FIG 5

THE FUR MARKET IN
OKLAHOMA



TRENDS IN PRICES AND PELT SALES

Due to a lack of systematic field information concerning fluctuations of fur-bearing animals it is somewhat difficult to properly evaluate the trends shown in the market. However, it appears that the influence of war economy may easily be distinguished.

Figure V shows the general trend of pelt sales in the state, the total annual income to trappers and the average price per pelt for each of the six seasons studied. These data show a steady decline in the number of pelts sold on the market each year. However, it is important to notice that this figure represents the bulk of all species marketed and so the trend is influenced largely by those species represented in the larger percents. Opossum pelts represent such a high percent of the total market that upward or downward trends of this species alone is often sufficient to mark the trend of the total market.

From a study of Figures V-XV we can see that striped skunk, opossum and civet or little spotted skunk are steadily declining on

the market. Other species are either shown to be extremely unstable in trend or are represented in increase. Bobcat and badger are relatively unstable and no definite trend is seen, possibly due to the fact that so few pelts are marketed each year. Raccoon and coyote, show fairly definite increase on the market.

Total pelt sales, including all species declined from 477,318, through 401,242; 326,895; 315,393; 298,146; to 278,297 for each of the years of 1938-39; 1939-40; 1940-41; 1941-42; 1942-43; and 1943-44.

The following table shows the species responsible for the decrease each year:

1938-39—Mink, opossum, muskrat and civet show decline.

1939-40—Skunk, opossum and civet show decline.

1940-41—Skunk, mink, muskrat, coyote, civet, bobcat, and badger show decline.

1941-42—Skunk, mink, civet, bobcat and badger show decline.

TABLE XXIII
FUR TRAPPER AND FUR DEALER LICENSE SALES
From 1930 to 1942

Year	Trapper Price	Dealer Price	Non-Resident Price
July 1, 1930— June 30, 1931	\$ 6,631.00	\$ 7,175.00 — \$25.00	
July 1, 1931— June 30, 1932	3,605.00	7,128.00 — 25.00	
TOTAL FOR BIENNIUM	\$10,236.00	\$14,303.00	
July 1, 1932— June 30, 1933	\$ 2,659.00	\$ 6,275.00 — 25.00	
July 1, 1933— June 30, 1934	2,565.00	8,850.00 — 25.00	
TOTAL FOR BIENNIUM	\$ 5,224.00	\$14,125.00	
July 1, 1934— June 30, 1935	\$ 2,453.00	\$ 8,250.00 — 25.00	
July 1, 1935— June 30, 1936	2,688.00	6,585.00 — 15.00	\$400.00 — \$50.00
TOTAL FOR BIENNIUM	\$ 5,141.00	\$14,835.00	\$400.00
July 1, 1936— June 30, 1937	\$ 2,611.00	\$ 7,605.00	\$600.00 — 50.00
July 1, 1937— June 30, 1938	2,449.00	5,190.00	350.00 — 50.00
TOTAL FOR BIENNIUM	\$ 5,060.00	\$12,795.00	\$950.00
July 1, 1938— June 30, 1939	\$ 2,010.00 (\$1.00)	\$ 4,665.00 — 15.00	\$300.00 — 50.00
July 1, 1939— June 30, 1940	1,722.00 (\$1.00)	4,995.00 — 15.00	350.00 — 50.00
TOTAL FOR BIENNIUM	\$ 3,732.00	\$ 9,660.00	\$650.00
July 1, 1940— June 30, 1941	\$ 1,341.00 (\$1.00)	\$ 4,365.00 — 15.00	\$400.00 — 50.00
July 1, 1941— June 30, 1942	1,864.00 (\$1.00)	5,175.00 — 15.00	350.00 — 50.00
TOTAL FOR BIENNIUM	\$ 3,205.00	\$ 9,540.00	\$750.00
Note—			
Fur Dealer and Trapper License Revenue prior to 1930.....	1926 (None)	1927 \$24,617.75	1929-1930 \$47,126.53

1942-43—Skunk, mink, civet, bobcat, badger show decline.

1943-44—Opossum shows decline.

The column in Figure V showing the total money received by trappers does not show the same decline as does the number of pelts marketed each year. This figure remained fairly consistent until the past 1943-44 season when the average price paid per pelt increased sufficiently to show a material increase in the total money received by the trappers.

The total money received by trappers has varied from \$162,352.70; \$132,598.16; \$143,161.28; \$142,201.89; \$140,004.54; to \$297,105.62 for each of the six trapping seasons from 1938-39 to 1943-44. The average price paid per pelt, figuring all species, during this period was 34c in 1938-39; 33c in 1939-40; 43c in 1940-41; 54c in 1941-42; 46c in 1942-43; \$1.03 in 1943-44.

Several factors appear to act directly in influencing prices and sales as shown in this phase of the report. The Bureau of the Census estimates that Oklahoma lost 168,368 people between 1940 and 1943. It is known that a large percent of this loss occurred within the lower income groups which would actually reflect in a reduction of the number of trapper operating in the state. Also the induction of farm boys into military service and the more pressing demands of other work has had much to do with the decrease of trapping activity. Large salaries and wages to be had in industrial work has induced many farmer trappers to move to the cities, and in general it appears that the portion of the human population doing the most trapping has suffered the greatest loss in rural areas.

Although not shown in these data, prices for pelts reacted rather violently to market peculiarities in 1943-44. Coyote pelts, for example, were selling during early season as high as \$12.00 to \$14.00 per pelt but in February dropped in many instances to as low as \$2.00 per pelt leaving some dealers unable to recover their losses.

The fluctuations of the number of pelts marketed per species and the average price paid per pelt are are illustrated on Figure V to XV for comparison.

In conclusion striped skunk, opossum, and civet show a definite decrease in number of pelts marketed throughout the six year period. Coyote, and raccoon show just as

definite an increase while the other species show considerable lack of stability in establishing a trend.

In view of the above mentioned disturbances of the fur trade, it is extremely questionable if we can see these declines of certain species as being the result of lower populations of fur-bearing species. It is known that mink, raccoon, badger, bobcat, and muskrat are represented in relatively fewer numbers in the field than are the other species. Opossum, striped skunk and civet are most abundant, yet striped skunk shows some tendency to be irregularly cyclic in its abundance. According to all our information civet and opossum appear to not only be declining on the market but are decreasing some in the wild.

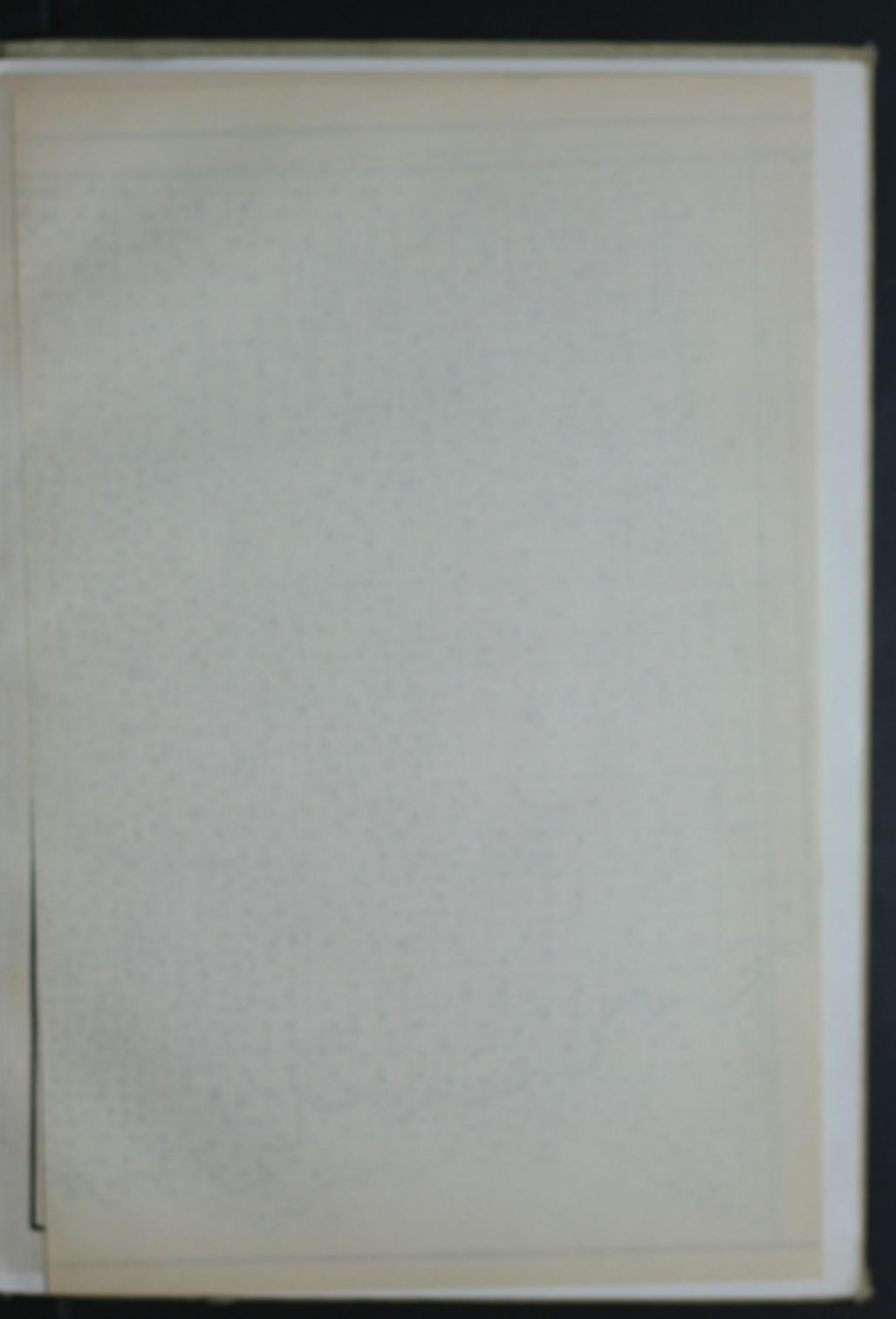
There is need of some careful field investigation on this phase of game management in Oklahoma.

COMPOSITION OF THE FUR TRADE BY SPECIES

OPOSSUM (*Didelphis virginiana*) (See Fig. VI.)

The opossum is the most common fur-bearer in Oklahoma and occupies a rather important place in the game picture in some areas. Too, it is somewhat widely utilized as food by some. In the western one-third of the state the animals are confined largely to timbered stream courses and bottomlands, from which they may forage for considerable distances at night. The areas of heaviest take are seen to be located within the Tall-grass and Post oak-Blackjack Game Types. Its association here is with farms and small towns.

The greatest number of pelts of any one species represented on the market is opossum. This species accounted for 70.16 percent of all the pelts marketed during the six year study period. But due to the relatively low price paid per pelt this figure accounted for only 34.28 percent of the total money received for furs. This species and the striped skunk by far outrank the other species in both number of pelts marketed and the amount of money received by trappers. Combined they account for around 92 percent of the pelts and 76 percent of the income from pelts. Opossum pelts bring the lowest price paid on the market for Oklahoma fur-bearers. During the study period they varied from 18c per pelt to 17c to 20c (no data for 1941-42) to 24c to 47c for each of the seasons ex-



l
l
l
n
t
n
f
w
c
c
t

v
l
6
l
E
K
l
n

n
F
S
E
t
v
c
c
d
c
v
c
v
d
c
t
t
r

f
E
h
n
a
o

n
p
V

a
b
p

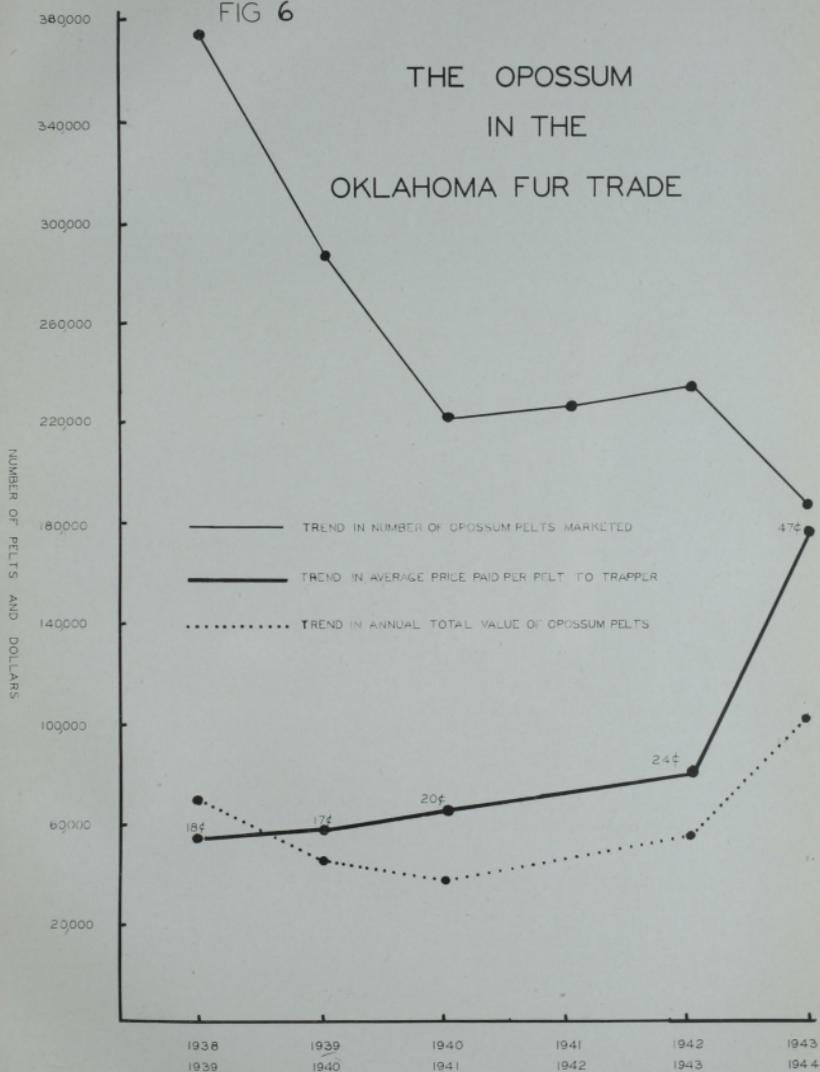
OPSSUM PETTS MARKTED

324204
1840-41

1807-108 PETTS

FIG 6

THE OPOSSUM
IN THE
OKLAHOMA FUR TRADE



clusive of 1941-42. They had an approximate value of \$63,103.14 for 1938-39; \$47,335.77 for 1939-40; \$44,166.00 for 1940-41; \$53,496.72 for 1942-43; and \$85,685.70 for 1943-44. Including the season of 1941-42 a total of 350,573; 276,681; 220,825; 220,912; 222,903 and 182-310 pelts were marketed during each of the successive seasons.

STRIPED SKUNK (*Mephitis mesomelas mesomelas* and *M. m. varians*) (Fig. VII).

There are two races of striped skunk in Oklahoma—the Louisiana skunk and the Longtailed Texas skunk. The Louisiana skunk is found more closely associated with the forested types of eastern Oklahoma, while the Longtailed Texas skunk is more often taken throughout the prairie and plains types. They appear to overlap at the western margin of the Mixed Grass Plains Type.

The most valuable fur producer in Oklahoma is the striped skunk. This species produced 42.19 percent of the total wealth from furs during the six year period. However, it only accounted for 21.98 percent of the total number of pelts marketed during this time. The average price per pelt for this species has varied from 68c for 1938-39; 63c for 1939-40; 74c for 1940-41 to 96c for 1942-43;* and \$1.89 for 1943-44 showing a steady increase in value. For the same years the total money received for skunk pelts has varied from \$63,203.64; to \$60,093.06; \$59,617.36; \$51,982.08 to \$126,654.57. The total number of pelts marketed declined during the same period from 92,948 to 95,862 to 80,564 to 71,443 to 54,148 to 67,013.

Although very meager, there is some evidence that the 1939-40 population was heavily parasitized and that the species was very abundant throughout the western one-half of Oklahoma. Statements of scarcity are common for the following year and the market shows a decline in number of pelts marketed.

Despite the lack of information concerning the population of this species, much can be done toward bettering conditions for its existence. It is common practice to dig out dens in the capture of skunk. This should be avoided. Dealers reported this species as increasing in the southwest and southeast and holding its own in the northwest and northeast.

CIVET (LITTLE SPOTTED SKUNK) (*Spilogale interrupta*) (See Fig. VIII).

The Little Spotted skunk, or Civet as it is more commonly known, is well distributed

over the state and is taken in every county with the exception of the western panhandle counties where records are not available. This species is best represented in the fur market in the west central and northeastern portions of the state. Civet during the six year study period accounted for 3.02 percent of the total number of pelts marketed and only 1.76 percent of the money received. Figure VIII shows civet to have a definite downward trend in the market and questioned dealers state this species is becoming less common on the market each year. The average price paid for this species varied from 21c for 1938-39 to 25c for 1939-40 to 19c for 1940-41 to 36c for 1942-43 to 65c for 1943-44. The species shows to have had an approximate value of \$4,158.67; \$3,910.25; \$1,824.57; \$1,784.88; \$4,052.10, for each of the above seasons. For the six years study 19,327; 15,641; 9,604; 7,836; 4,958; and 6,234 pelts were marketed for this species during each of the six seasons.

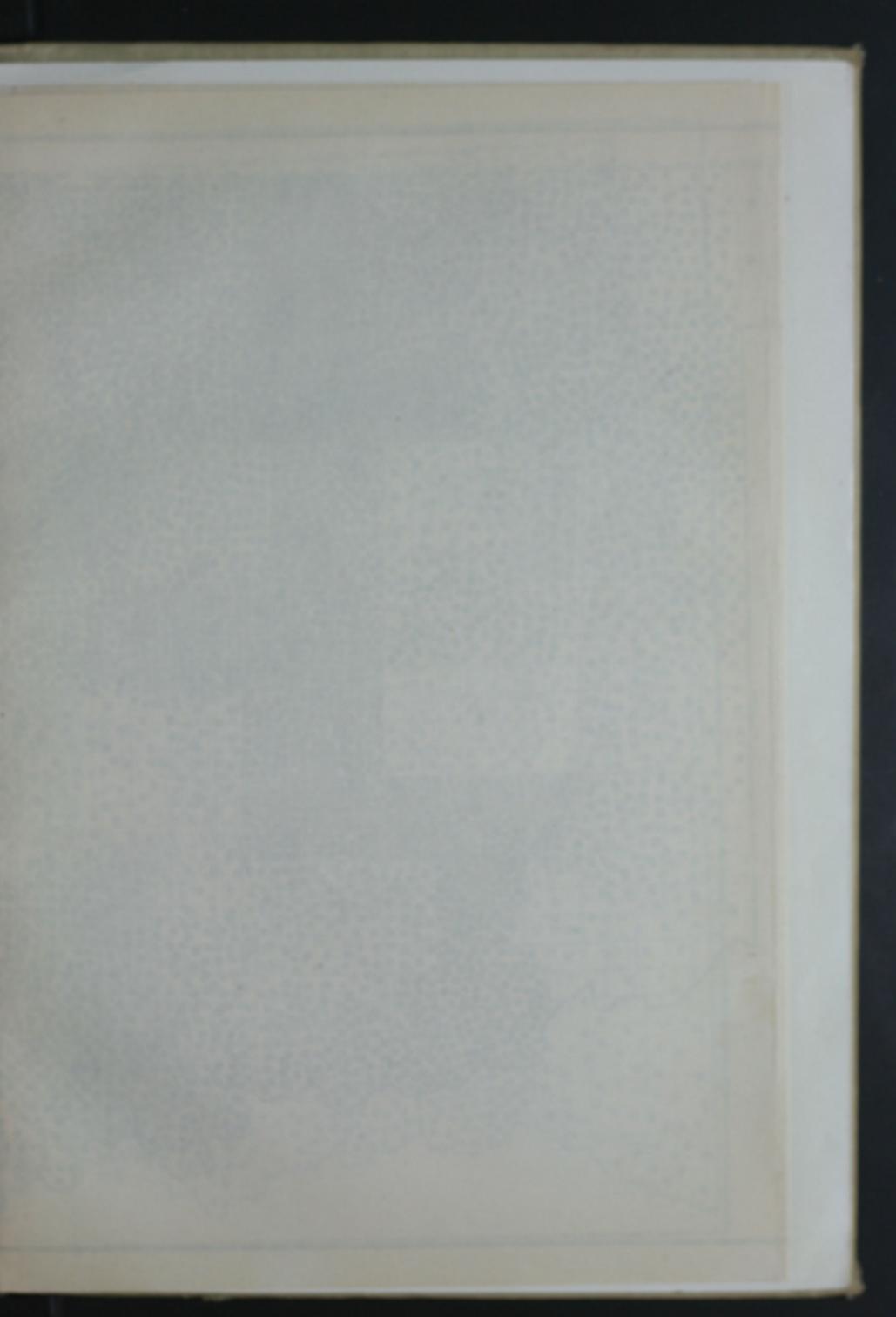
MUSKRAT (*Ondatra Zibethica*) (See Fig. IX).

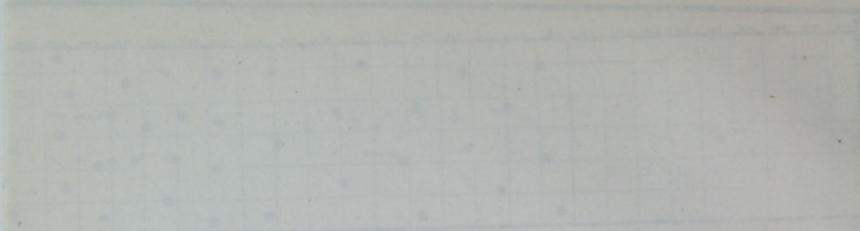
The bulk of the muskrat pelts sold on the market in Oklahoma come from the northern two-thirds of the state. The Arkansas, Grand, Canadian, Verdigris and Washita rivers appear to support the major portion of the fur take. One of the factors operating against a higher and more consistent muskrat population in Oklahoma is the unstable water level of the most of the suitable muskrat habitat. The ecology of the species is little known in this region and some study would be worthwhile.

Muskrat shows an extremely unstable condition of market with no trend being evident. The two recent seasons, however, have been toward increase. This species, for the six year period accounted for 2.14 percent of the total pelts and 4.39 percent of the money received for pelts. The average price for muskrat varied through the six year period, excluding 1941-42, 58c; 60c; 98c; \$1.10; and \$1.50. Total calculated value of muskrat pelts for these same years was \$4,714.82; \$3,870.00; \$6,590.50; \$8,591.00; \$13,911.00. Total pelts marketed for each of the years represented were 8,129; 6,450; 6,725; 6,638; 7,810; 9,279.

Dealers questioned believed muskrat to be increasing generally throughout the northern portion of the state. There is much that can be done toward extending muskrat habitat in Oklahoma. Much of the water areas in

*Note: Average price per pelt not available for the season of 1941-42.





STRIPED SKUNK PELTS MARKETED

SEASON
1940-41

1007-10 PELTS

FIG 7

THE STRIPED SKUNK
IN THE
OKLAHOMA FUR TRADE

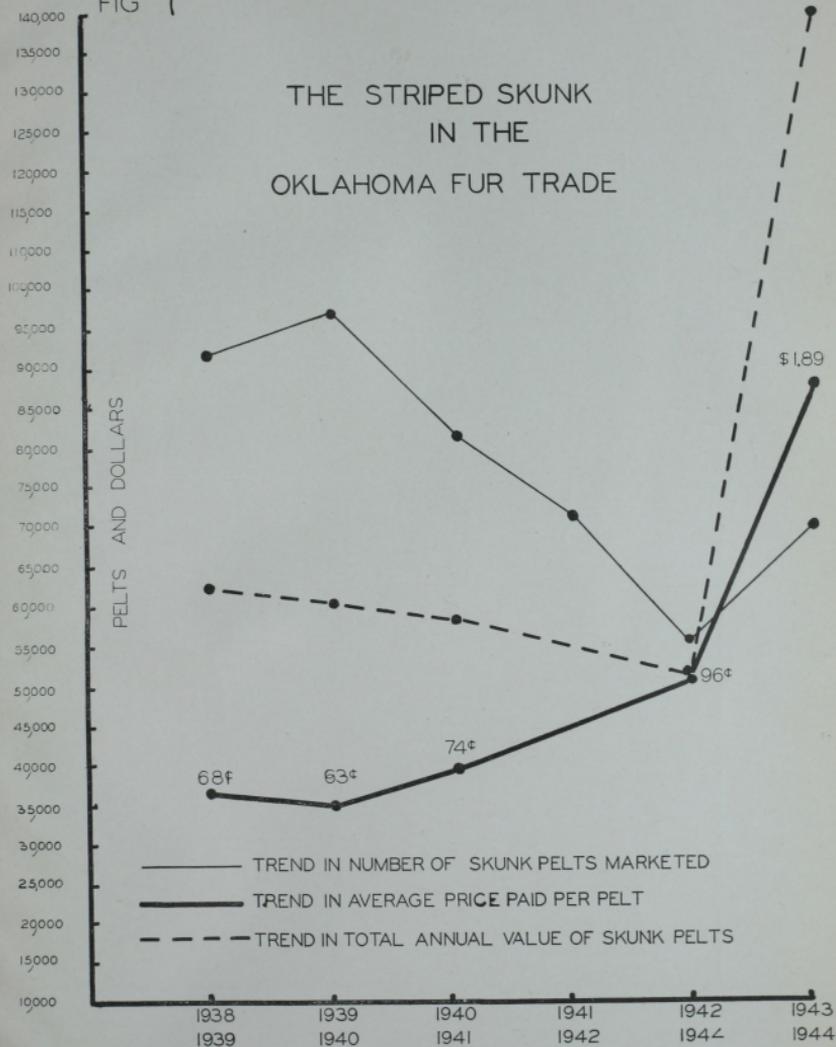
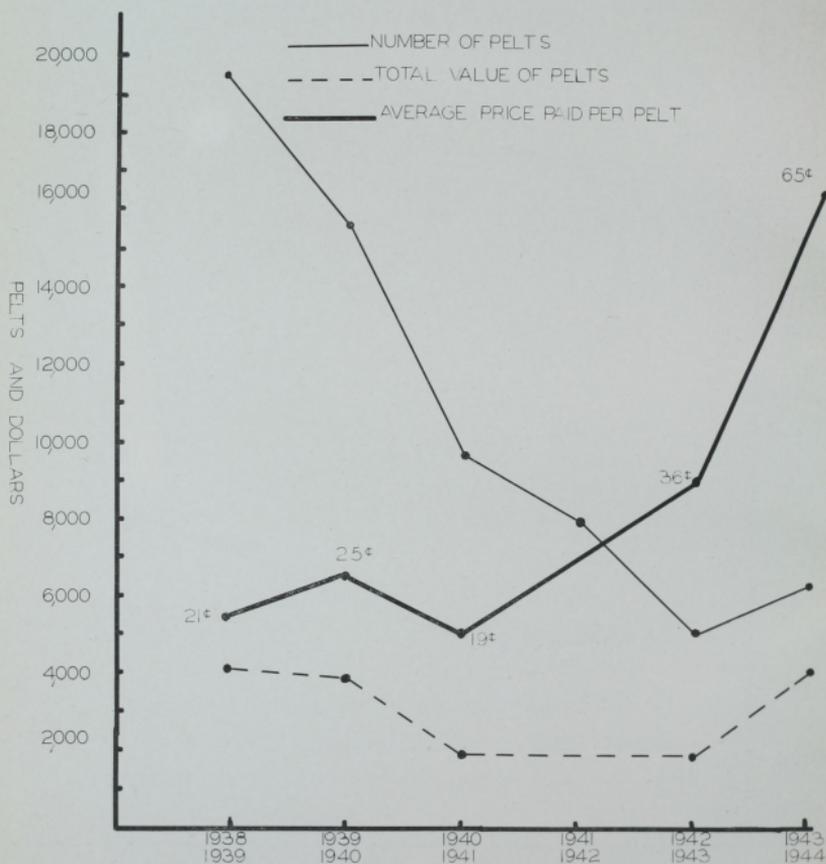
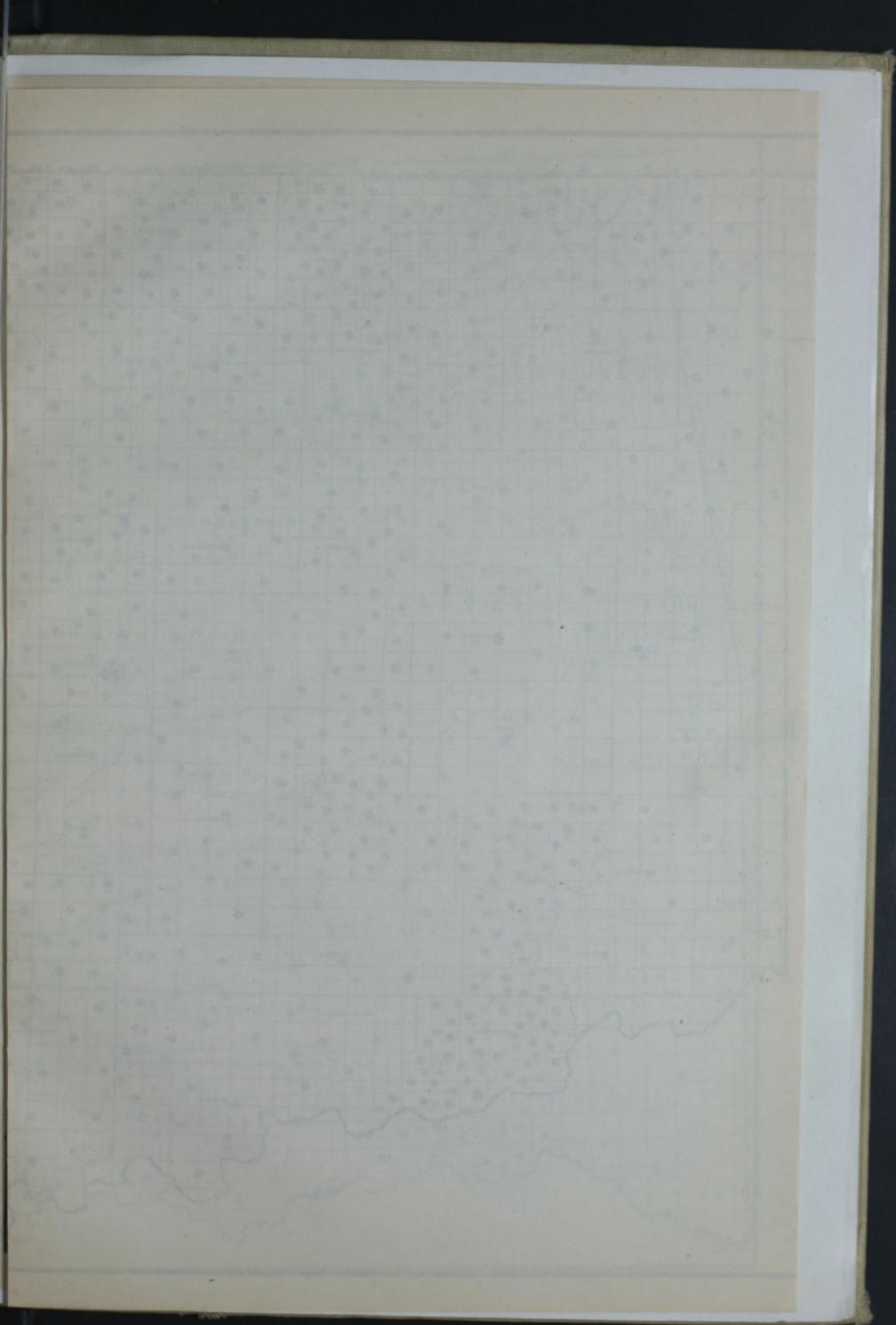


FIG 8 THE SPOTTED SKUNK CIVET





LITTLE SPOTTED SKUNK OR
CIVET CAT BELTS MARKED

LITTLE SPOTTED SKUNK OR
CIVET CAT BELTS MARKED

SEASON
1940-41

100-10 BELTS

the southern portion of the state is at present not producing pelts in any appreciable numbers, and some investigation should be carried out to determine the possibilities for managing the species in these areas.

RACCOON (*Procyon lotor*)

The raccoon serves a dual purpose in the Oklahoma game picture. It is an important game animal throughout the state where it is abundant enough for the sport, and further serves as an important fur-bearing species on the fur market in certain counties. Generally, the animal is distributed over the

by over-hunting in certain areas. Two desirable characteristics of raccoon habitat are large den trees and water, from which food can be obtained. Although through much of the western range the large den trees are very scarce, the building of farm ponds has resulted in some little increase in raccoon range and populations. Further expansion can come from development of the habitat surrounding these farm ponds and lakes.

Raccoon pelts have increased on the market steadily through the six year study period. A total of 1981 pelts were marketed



Plate LVII—Artificial den. A part of the research in Raccoon Restoration.

state, but becomes very scarce westward, where its range is confined to the wooded ravines and stream courses.

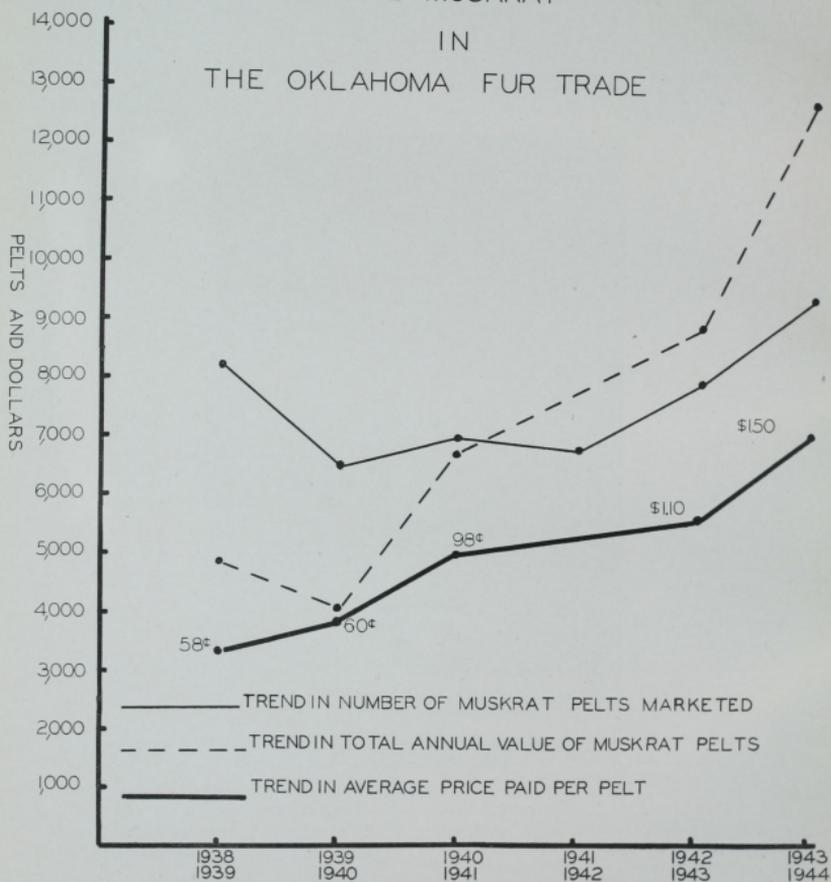
More time has been spent on raccoon during the survey than on other fur-bearing species because of its sporting value and, too, because it appeared in the beginning to be occupying but very little of the suitable range in sufficient numbers. Raccoon populations have suffered much from human abuse of the habitat. Low populations almost always are reflected by excess cutting of den trees, trampling and silting of stream vegetation, by poor use of the uplands, and

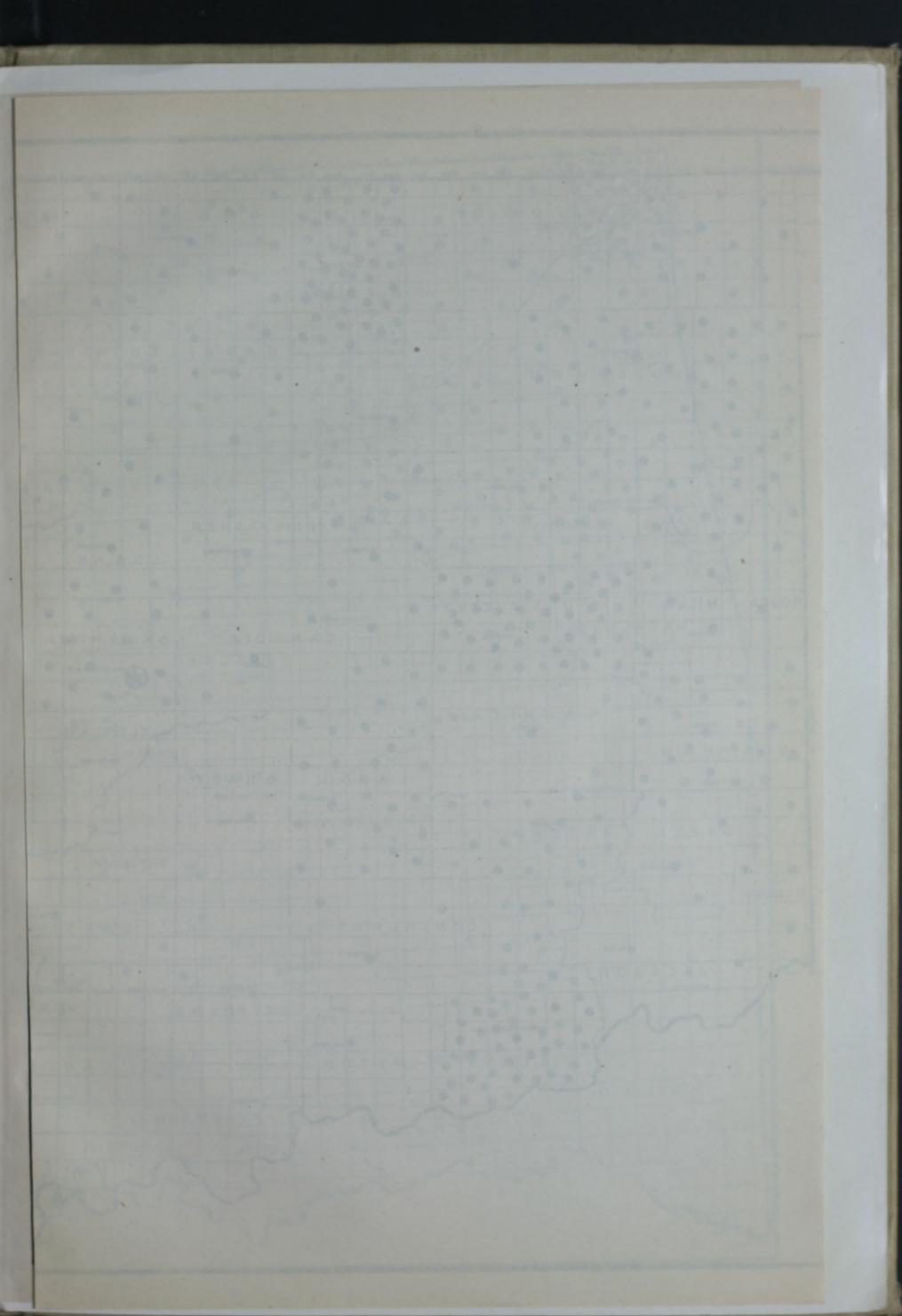
in 1938-39, and for each of the succeeding years, 2,318; 3,099; 3,226; 3,350 pelts were marketed with a total of 4,843 reported for the 1943-44 season. For the total six year average raccoon accounted for 0.80 percent of the pelts marketed and 3.72 percent of the money received for pelts.

Approximate value of all raccoon pelts marketed amounted, for each of the study years excluding 1941-42, totals of \$2,297.76; \$2,252.10; \$6,031.35; \$6,901.06; and \$14,483.23.

FIG. 9

THE MUSKRAT
IN
THE OKLAHOMA FUR TRADE





MUSKRAT PELTS, MARKETED

SEASON
1940-41

1 DOT-10 PELTS

The steady rise in importance of raccoon in the fur market as shown in this work, appears to be due at least in part to chance. That is, the data is available only from years showing an upswing. From careful interviews it has been concluded that raccoon hunting and trapping, particularly hunting, is cyclic. That is, starting at a time where raccoon are abundant, the taking of raccoon for sport generally grows in popularity in a locality. Interest in good raccoon hunting dogs increases until, in certain sections at

pine forest types, abuse of the habitat by human beings has contributed most toward the present low raccoon populations. Den trees throughout this portion of the state are largely confined to the relatively narrow margin of stream bottom, and the cutting of these trees is common practice. Habitat is further reduced by overgrazing of both the bottomlands and upland pasture, and from cultivation which allows silt to choke out the vegetation and permits a quick run-off of precipitation. Historical literature shows that



Plate LVIII—Coon hunter-sportsman assisting in the raccoon restocking work.

least, hunting of raccoon becomes a major sport. However, as the hunting becomes intense, raccoon gradually become scarce due to the heavy take, and eventually interest in the community dies because of the low populations. Then during a period of less raccoon hunting, populations again reach higher levels. This appears to hold good for areas where habitat conditions are desirable.

However, over most of Oklahoma, particularly west of the Oak-hickory and Oak-

many of the smaller streams of the state once maintained a much more permanent water flow than is true under present agricultural methods.

It is readily seen in Oklahoma that raccoon is a species which benefits from refuge protection, providing the habitat is suitable. At present the stock used for restocking purposes comes from several refuge areas of excellent living conditions for raccoon, and where the animals are abundant.



Plate LIX

Tagging trapped raccoon with aluminum ear tag so a check-up can be made after release.

Plate LX
Technician transferring live raccoon from tagging net to delivery crate.



On the basis of this information, work was started in late summer of 1940 to develop methods of obtaining raccoon for restocking. During a period of five nights and using sixteen traps, twenty-five raccoon were captured. These were weighed, tagged, sexed and released in other areas. With this information, it appeared that a large scale trapping project could be developed.

During July and August, 1943, seventy-two raccoon were trapped from areas of concentration and released on protected areas throughout central and western Oklahoma as breeding stock. As a further experimental phase of this work, thirty artificial dens were erected in an area of excellent habitat con-

gressed, it appears that in Oklahoma, raccoon may be restored to depopulated areas by transplanting of breeding stock, providing the habitat is suitable; also that, in the absence of den sites, artificial dens may be made to serve as a means of attracting the animals.

Generally raccoon populations are seen to benefit from such management practices as:

- (1) Protection of small sections of woodland from grazing and burning.
- (2) Construction of small levees on sloughs along creeks so that frogs, crayfish and small fish may be available.



Plate LXI—Raccoon released on selected refuge—a part of the restoration program.

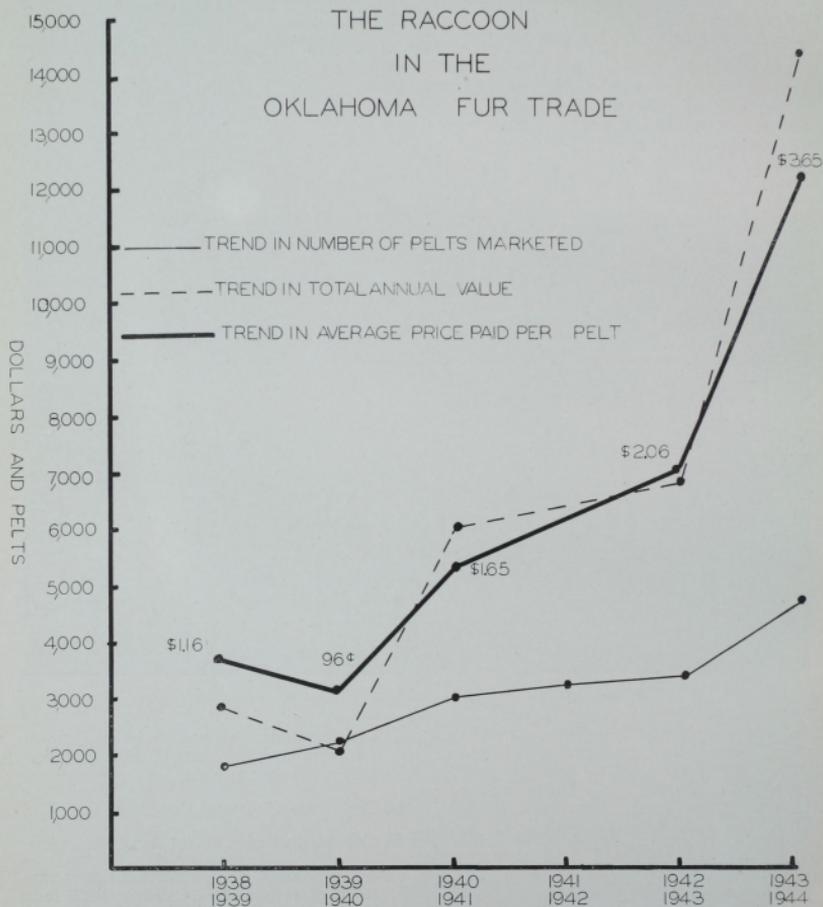
dition to determine their value for raccoon use. These dens were of two types. In one, use was made of hollow logs by sawing them in 6'-8' lengths, covering both top and bottom, and making an entrance in one side. The other type was constructed of rough oak slabs approximately 2" x 12" x 6" in dimension.

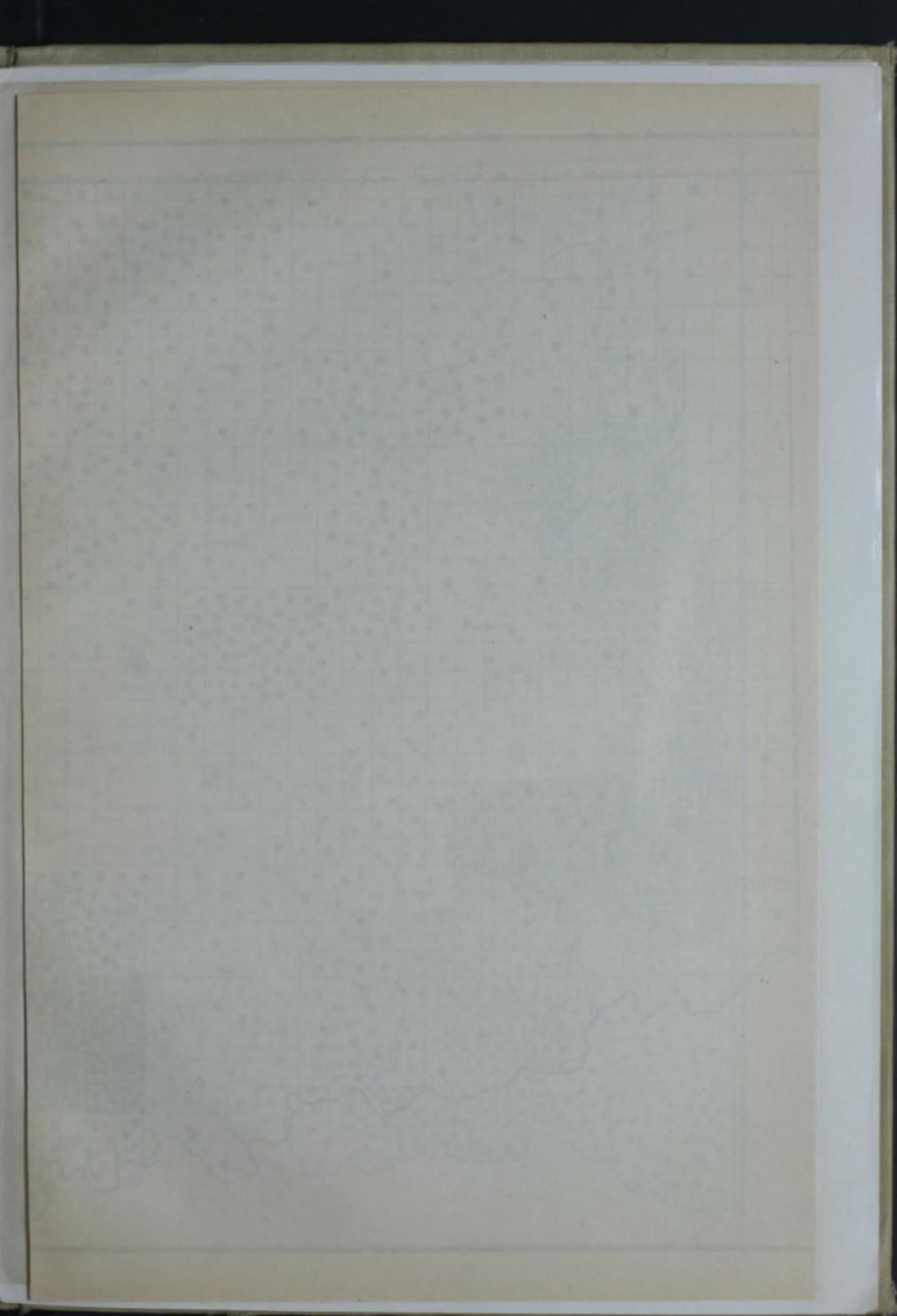
At the present date these dens are being used by raccoon in preference to some natural denning sites in the vicinity. However, other species such as gray and fox squirrel, opossum and various owls, are also using the dens. Nevertheless, despite the short period over which this investigation has pro-

- (3) Encouragement of such fruits as grapes, persimmon, blackhaw, hackberry, pokeberry, blackberry, etc.
- (4) Protection of natural den trees.
- (5) Construction of artificial dens.
- (6) Establishment of a systematic management of refuge areas no less than four square miles in size throughout the raccoon range.
- (7) Seasonal limits on raccoon, taken by one individual, particularly throughout areas in need of the stock.

FIG. 10

THE RACCOON
IN THE
OKLAHOMA FUR TRADE





VALLENS RND 11113

RACCOON BELTS MARKED

SEASON
MARCH

1907-1908



Plate LXII
Removing raccoon from trap.

Plate LXIII
Raccoon trapped for restocking purposes. Sportsmen aiding in the trapping.



WOLVES AND COYOTE

(*Canis latrans nebrascensis*—Coyote)

(*Canis latrans texensis*—Coyote)

(*Canis rufus rufus*—Texas red wolf)

(*Canis lupus nubilus*—Gray or timber wolf)

According to our best information, there are two subspecies of coyote in Oklahoma and two separate wolves. The common prairie coyote (*Canis latrans nebrascensis*) is the coyote most commonly met with over the state. The subspecies (*Canis latrans texensis*) is recorded only from the Wichita Mountains. The Texan red wolf (*Canis rufus rufus*) is taken over most of the state, while the gray or timber wolf (*Canis lupus nubilus*),

marketed for each of the study seasons are 972; 1,323; 2,292; 1,468; 1,806; 2,349. The average price paid per coyote pelt, for each season, excluding 1941-42 varied through \$1.58; \$1.00; \$1.00; \$3.54; and \$5.24. Total approximate values are for the same years, \$1,535.76; \$1,323.00; \$2,292.00; 6,393.24; \$12,308.76.

From all evidence, it appears that coyotes are on the increase. They are being recorded in more eastern timbered sections, and reports of depredation to livestock, particularly sheep and poultry, are common from the prairie and plains sections.

Control of the gray or timber wolf is generally effective and its numbers are much



Plate LXIV—The stomach contents of the coyote were analyzed and found to consist of rabbit.

lower than they were thirty years ago. It is doubtful if this is true of the coyote and evidence points to their being more numerous that at the time of settlement.

although once found over most of the state, is largely confined to the western portions and the Wichita Mountains area.

It is difficult to distinguish between the coyotes and wolves on the fur market. Many buyers are unable to separate the two animals, which make their treatment here unreliable on that basis. However, coyote appear to outrank the wolves in pelt sales in Oklahoma. (See Fig. XI and XII).

The coyote is one of the most destructive of predators in Oklahoma, and, while it is known that they do not seriously damage game populations other than rabbits, their take of poultry and sheep constitutes a loss of some proportion in the state.

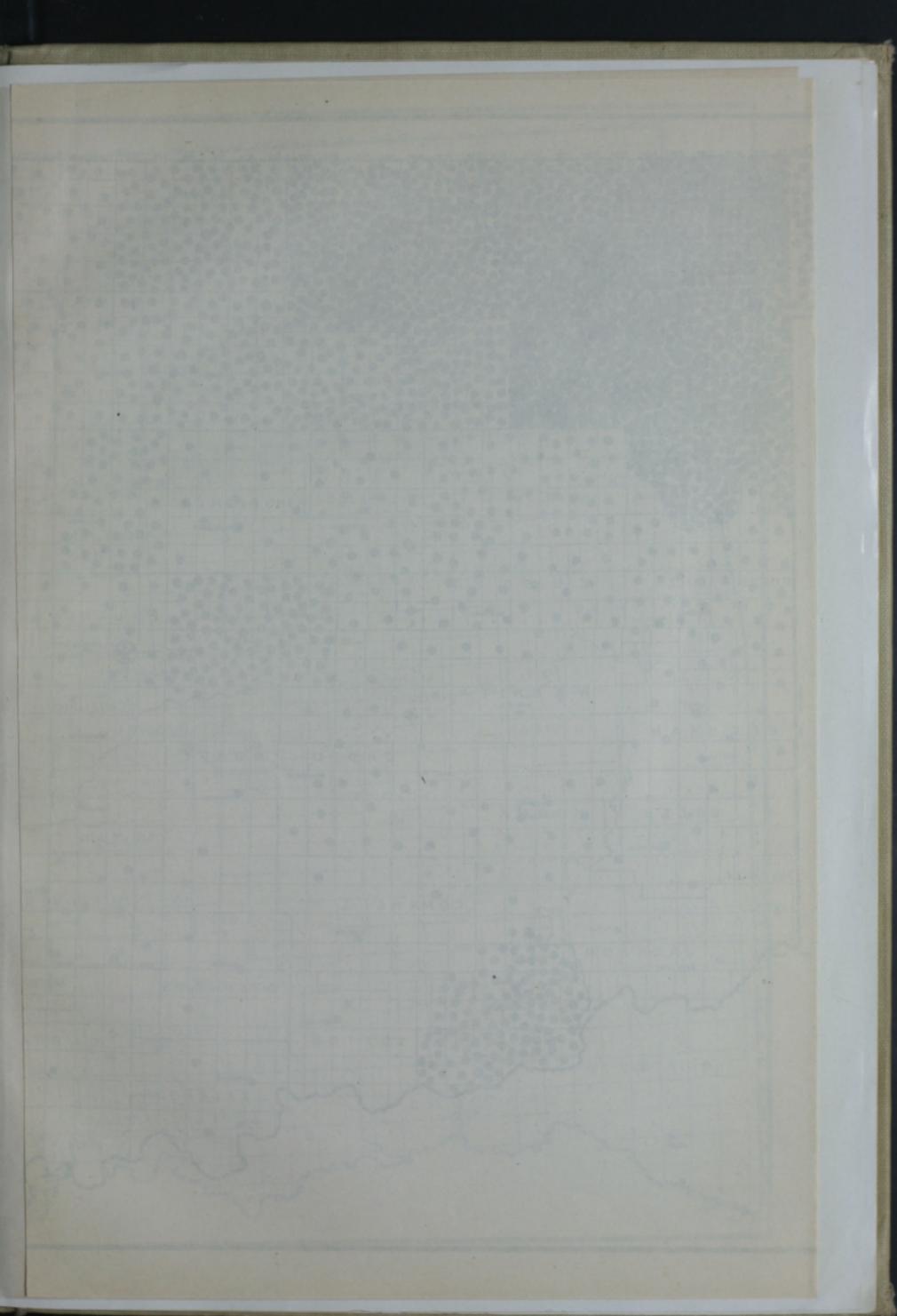
Coyote pelts accounted for 0.48 percent of all pelts marketed during the study period, and 2.78 percent of the money received. This has shown a general increase on the market, with considerable fluctuation in trend indicated. The total number of pelts

lower than they were thirty years ago. It is doubtful if this is true of the coyote and evidence points to their being more numerous that at the time of settlement.

The coyote is one of the most destructive of predators in Oklahoma, and, while it is known that they do not seriously damage game populations other than rabbits, their take of poultry and sheep constitutes a loss of some proportion in the state.

MINK (*Mustela vison*) (See Fig. XIII).

The mink is the most valuable individual fur-bearer in Oklahoma that may be trapped under the existing laws. It is found associated with all major water systems of the state,

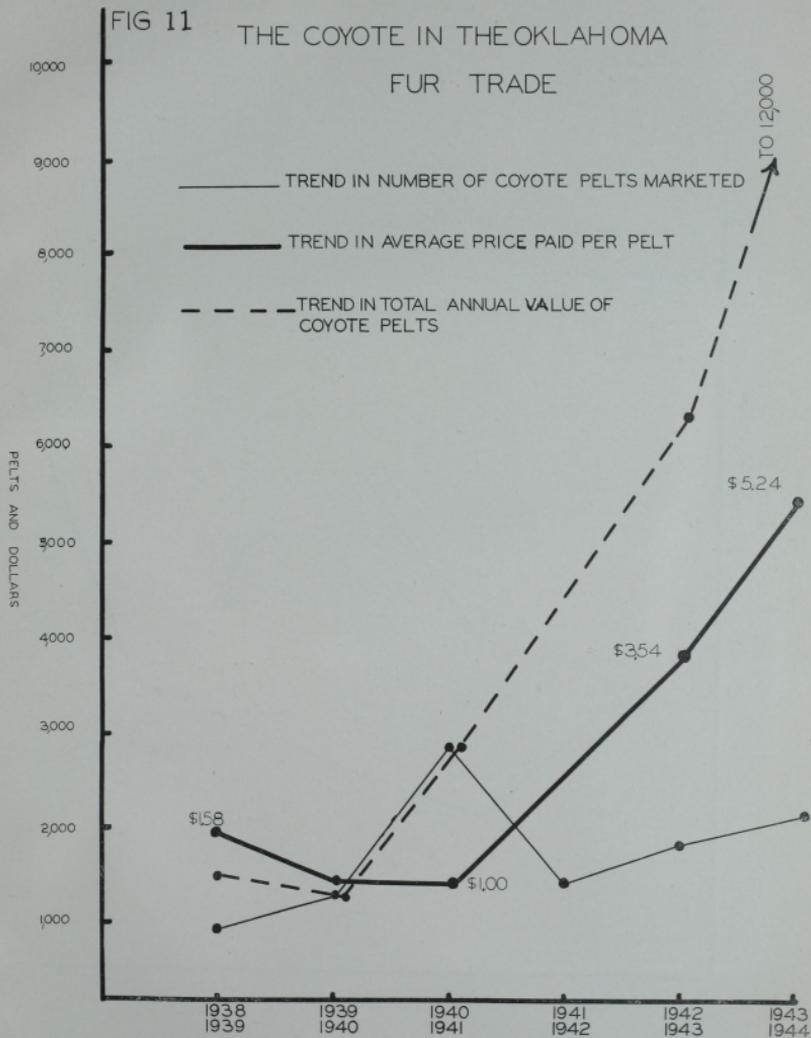


COMBINED COYOTE & WOLF
PELTS MARKETED

SEASON
1940-41

100% BELT

FIG 11 THE COYOTE IN THE OKLAHOMA
FUR TRADE



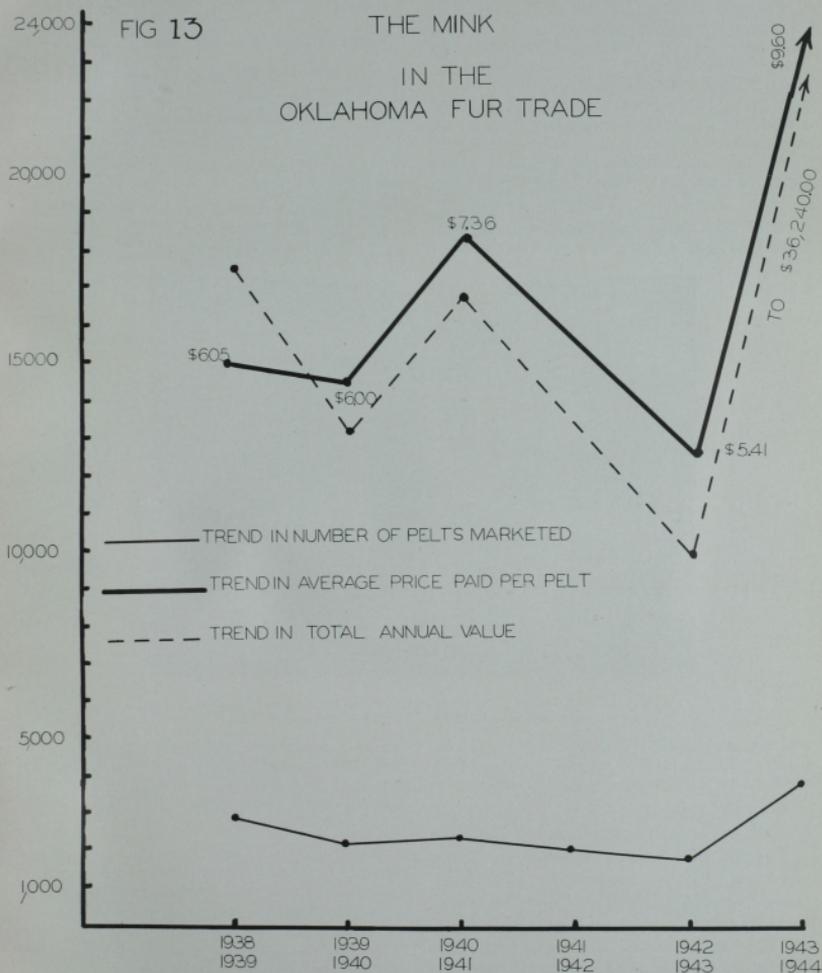
MINK PELTS MARKETED

SEASON
1940-41

1 DOT PELTS

FIG 13

THE MINK
IN THE
OKLAHOMA FUR TRADE



but appears to be generally low in number throughout. It is becoming seriously low in most sections west of the eastern two-thirds of the state and is in need of at least local protection for a few years. No doubt, studies and seasons by watershed classification would result in more success than regulations by counties. Considering the general high price paid for mink pelts and the vast amount of potential habitat for the species in the state, it appears that along with raccoon, this animal should warrant some efforts toward restoration. In any proposed program intended to benefit fur-bearers, mink should receive considerable attention. Mink has been known to react favorably to

BOBCAT

(*Lynx rufus baileyi*—Bailey Bobcat; Plateau Bobcat)

(*Lynx rufus rufus*—Boy Lynx Bobcat)

The bobcat of western Oklahoma is known as Bailey's Bobcat and appears from skins to differ considerably from those taken in the forested regions of eastern Oklahoma. However, from the literature, it is difficult to determine if they are treated separately. Until an authoritative opinion is available, it appears that the eastern animal may be referred to as (*Lynx rufus rufus*).



Plate LXV—Showing game ranger with two bobcats trapped in part of study on food ecology and ecology of this species.

various watershed improvements such as pond building, lake construction and other methods of improving stream conditions.

Mink, a high value pelt accounted for 9.75 percent of the money received, but only 0.80 percent of the pelts marketed. The average price paid the trappers for mink pelts varied from \$6.05 to \$6.00 to \$7.36 to \$5.41 to \$9.60 for the five seasons for which figures are available (1941-42 not available). The approximate value of all mink pelts marketed during these seasons were \$17,466.35; \$13,176.00; \$16,721.92; \$9,986.86; and \$36,240.00. A total of 2,887; 2,196; 2,272; 2,003; 1,846; 3,775 pelts were marketed during each of the study periods.

As a fur-bearer the bobcat is relatively unimportant, and usually less than 100 pelts are marketed each year in Oklahoma. The average price varies around \$1.00 per pelt. (See Fig. XIV).

As a predator, however, this animal is subject to much controversy. Generally throughout its western range, cattlemen do not encourage the taking of bobcat purely as a predator. Many feel that the preponderance of such rodents as rabbits, kangaroo rats and prairie dogs in its diet more than offset the damages. Running bobcat with dogs on many western ranches is looked on with disfavor. In eastern Oklahoma, however, many feel that bobcat create a heavy predator pressure on deer at fawning time.



GREY FOX PELTS MARKETED

SEASON
1940-41

1 DOT 1 PELT

FOXES (*Vulpes fulva*—Red fox)(*Vulpes velox velox*—Kit fox)(*Urocyon cinereoargenteus ocythous*—Gray fox)

There are three foxes in Oklahoma. The red fox (*Vulpes fulva*) is largely confined to the eastern sections. However, its total range within the state is not accurately known. The kit fox (*Vulpes velox velox*) occurs throughout the panhandle and the western counties and is very rare. It is seldom seen or taken in traps, although in earlier days it was frequently seen throughout this area.

The gray fox (*Urocyon cinereoargenteus ocythous*) is most abundant in the eastern

WEASEL (*Mustela frenata primilina*)

According to Blair (1939) this animal is reported from the eastern two-thirds of Oklahoma. However, in the fur reports the weasel is recorded from some of the western counties. Very little is known concerning this animal in Oklahoma and it is rarely taken in fur season. Thirty nine pelts were marketed in 1938-39, 44 in 1939-40, 66 in 1940-41, 4 in 1941-42, and 14 in 1942-43. The average price per pelt varies around 45c to 65c.

BADGER (*Taxidea taxus*) (See Fig. XV)

The badger is an animal of the plains, prairies and open forests in Oklahoma, and occurs more in the western half of the state. The largest take for fur comes from the north-



Plate LXVI—Beaver cuttings on the North Canadian River, Woodward county.

timber game types. Cherokee and Adair counties produce the greatest number of marketed pelts.

The taking of gray fox as a fur-bearer was allowed for the first time in several years during 1940-41. During this season 438 pelts were marketed and in 1941-42, 1,141 were sold. In 1942-43 the sale decreased to 898 pelts and in 1943-44 a total of 1,561 fox pelts were marketed. The average price per pelt for this species varies from \$1.30 to \$1.25.

With some attention to den sites and general habitat, both the gray and red fox should be utilized in Oklahoma on a regulated basis. The red fox is an excellent game animal and produces a good pelt in Oklahoma.

western section including the three panhandle counties. Badger pelts represented from 0.03 to 0.16 percent of the total pelts for the six year period included in this study. A total of 174 pelts were marketed in 1938-39; 212 in 1939-40; 430 in 1940-41; 208 in 1941-42; and 108 in 1942-43 and 509 in 1943-44. The average price paid per pelt for this species ran from \$1.00 to \$1.80.

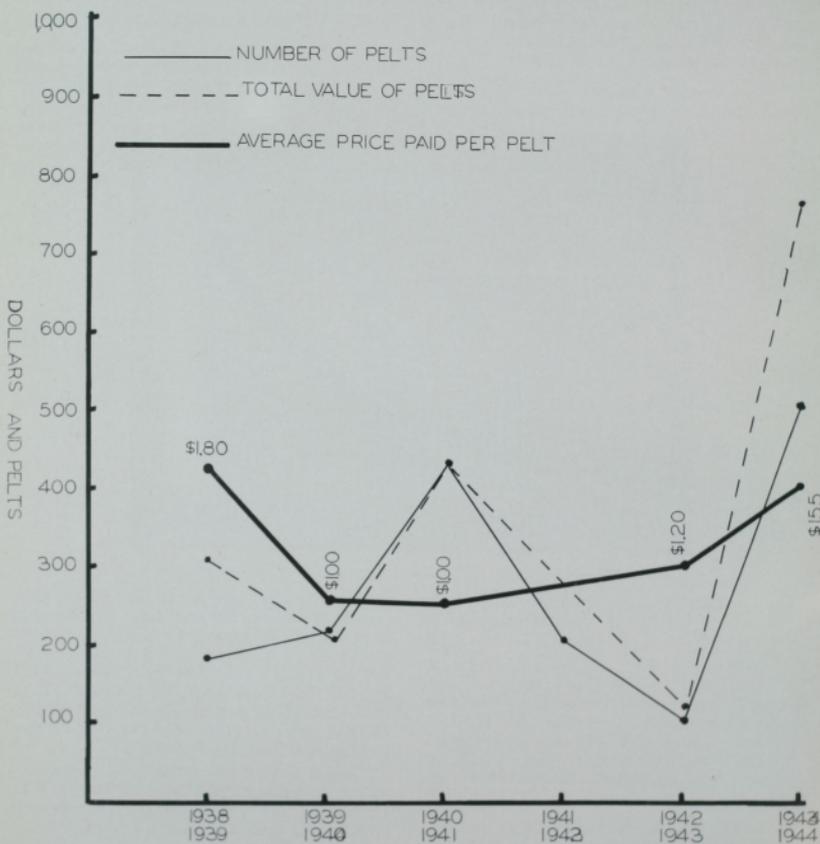
Cultivation of the grasslands has eliminated the badger from most of its range in Oklahoma and it is doubtful if extensive recovery will ever be possible.

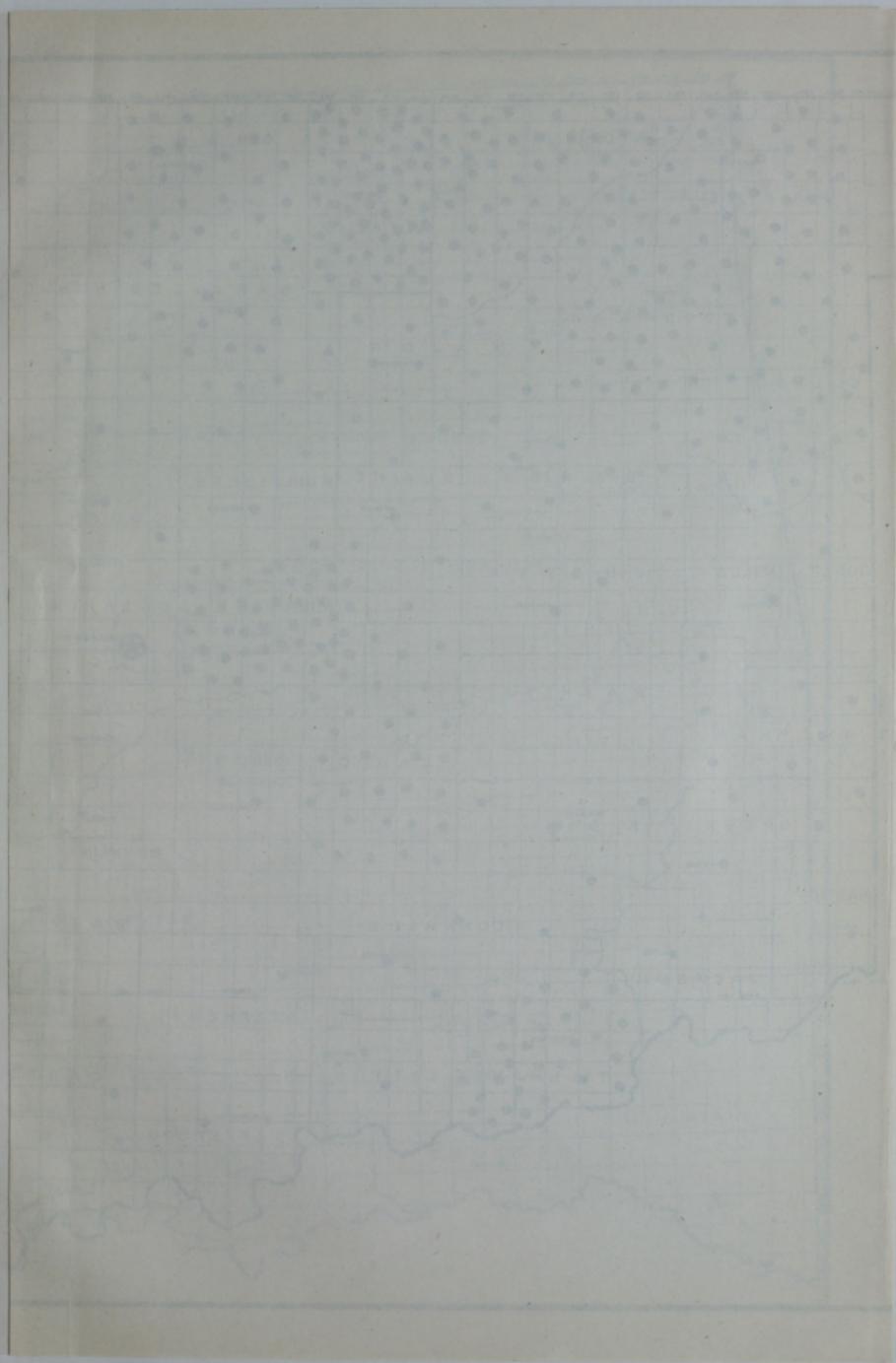
HOUSE CAT.

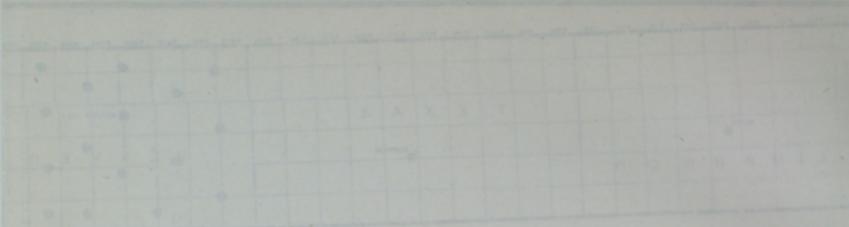
House cat pelts are sometimes sold for furs and bring from 20c to 30c apiece. In 1938-39 a total of 589 pelts were marketed.

FIG 15

THE BADGER







BADGER PELTS MARKETED

SEASON
1940-41

100.1 PELT

However, since then between 20 and 100 are recorded each year.

BEAVER (*Castor canadensis*).

The beaver was apparently on most of the streams of the state at one time. It does not appear that trapping of this animal was intensive in Oklahoma during the early days of the great fur trade. However, some records are available showing pelts were taken. In 1824, 387 beaver pelts were shipped from Choteau Trading Post at the mouth of the Verdigris river.

Today the bulk of the beaver population is found on the Washita river, North Canadian river, and some colonies are located in Atoka, Pushmataha and Pawnee counties.

Restoration of beaver, at present, does not appear possible. They compete with agricultural interests and prove very unpopular in most sections.

OTTER (*Lutra canadensis*)

Records show that Otter was once encountered all over the state with the possible exception of the panhandle counties. It appears to be making a recovery in eastern Oklahoma at present. In view of its value

as a fur-bearer, some investigation toward restoration is justified.

TABLE XXIV

SHOWING COMPOSITION OF OKLAHOMA FUR INDUSTRY

(6 Year Average 1938-39-1943-44)

STRIPED SKUNK	
Percent of Total Pelts.....	21.98
Percent of Total Value.....	42.19
OPOSSUM	
Percent of Total Pelts.....	70.16
Percent of Total Value.....	34.28
SPOTTED SKUNK (Civet)	
Percent of Total Pelts.....	3.02
Percent of Total Value.....	1.76
COYOTE	
Percent of Total Pelts.....	0.48
Percent of Total Value.....	2.78
MINK	
Percent of Total Pelts.....	0.80
Percent of Total Value.....	9.75
RACCOON	
Percent of Total Pelts.....	0.80
Percent of Total Value.....	3.72
MUSKRAT	
Percent of Total Pelts.....	2.14
Percent of Total Value.....	4.39
WOLF, BADGER, RED FOX, GRAY FOX	
Percent of Total Pelts.....	0.47
Percent of Total Value.....	1.07

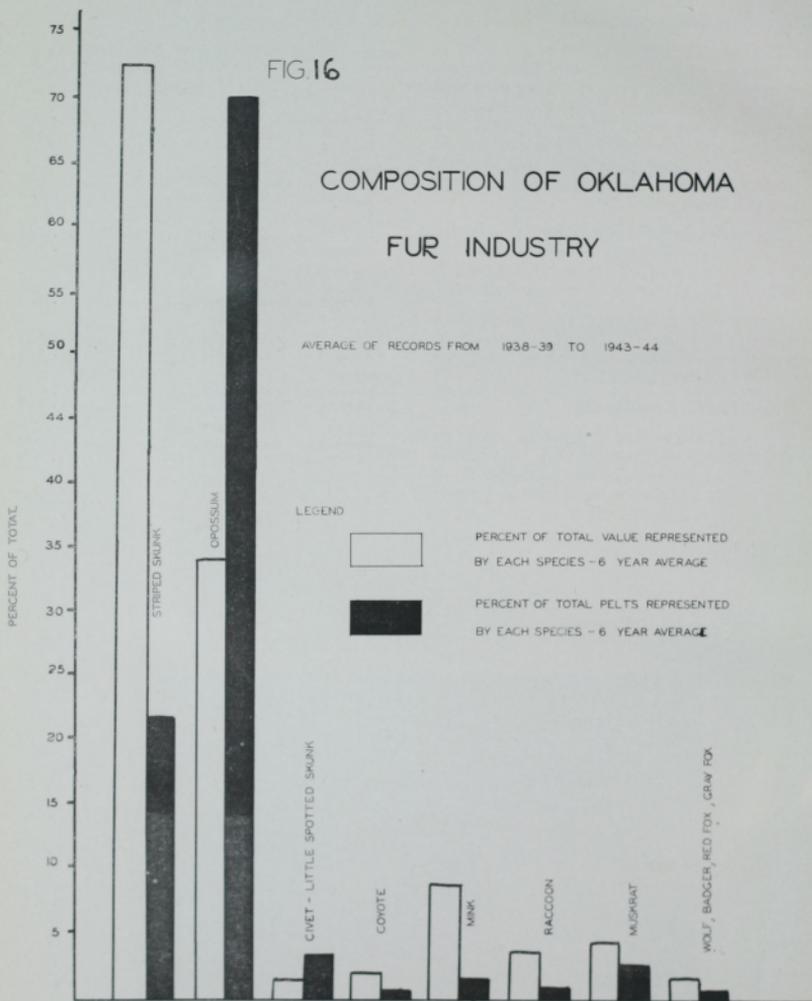


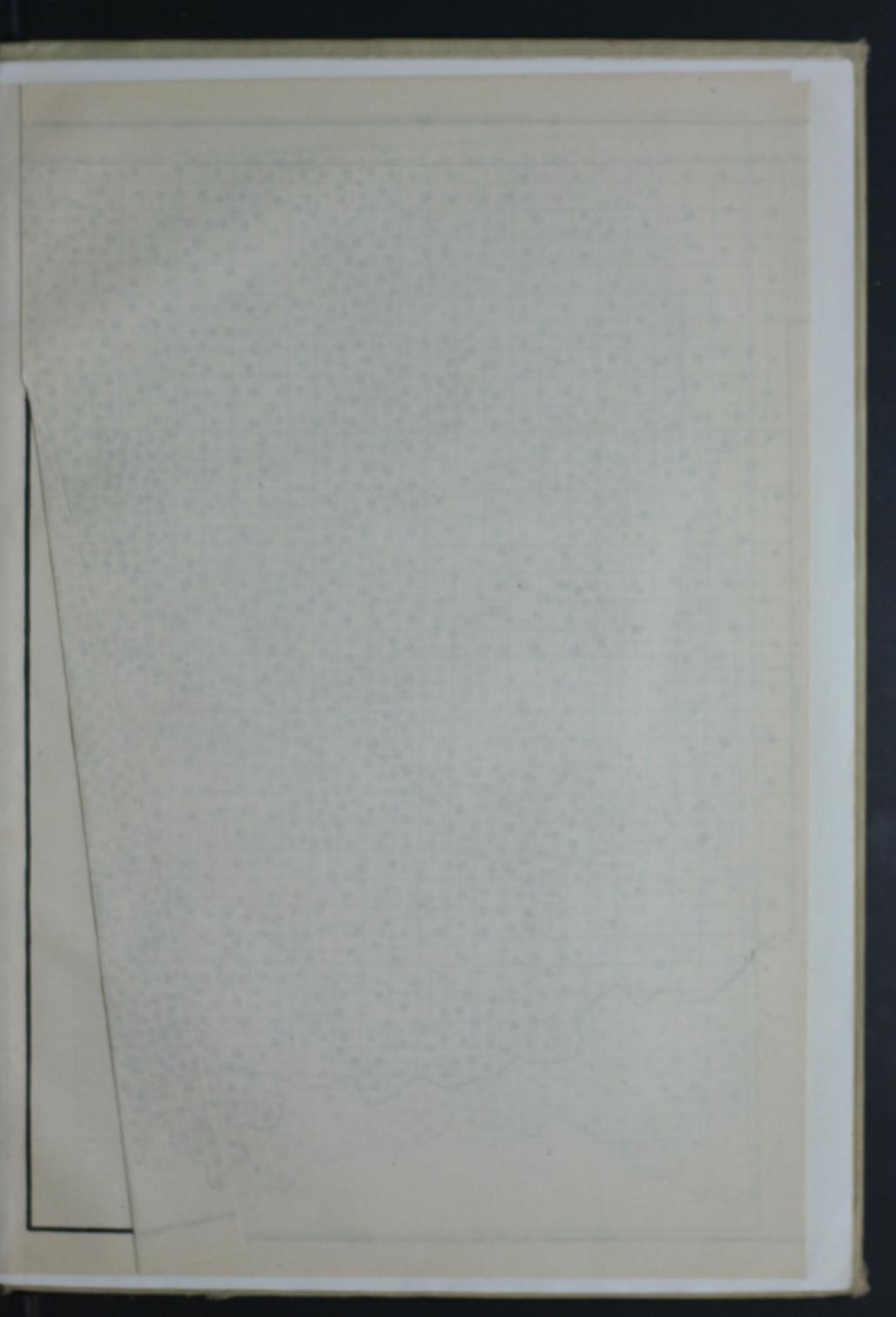
Plate LXVII—Beaver damage to large tree, Major county.

FIG. 16

COMPOSITION OF OKLAHOMA FUR INDUSTRY

AVERAGE OF RECORDS FROM 1938-39 TO 1943-44





TOTAL BELTS MARKETED
BY COUNTY

SEASON
1940 - 41

1 DOT 100 BELTS

TABLE XXV
TABULATED FUR RECORDS FOR OKLAHOMA
1938-39—1943-44

ANIMAL	YEAR	Total Pelts	Percent of Total Pelts	Approximate Value	Average Price Per Pelt	Percent of Total Retail Income
Badger	1938-39	174	0.03	8 313.20	\$1.80	0.19
Badger	1939-40	212	0.05	212.00	1.00	0.15
Badger	1940-41	430	0.13	430.00	1.00	0.31
Badger	1941-42	208	0.06			no data
Badger	1942-43	108	0.03	129.60	1.20	0.29
Badger	1943-44	509	0.18	788.95	1.55	0.29
Bobcat	1938-39	87	0.01	121.80	1.40	0.07
Bobcat	1939-40	128	0.03	128.00	1.00	0.09
Bobcat	1940-41	134	0.04	134.00	1.00	0.09
Bobcat	1941-42	83	0.02			no data
Bobcat	1942-43	76	0.02	21.38	0.28	0.01
Bobcat	1943-44	142	0.06	200.22	1.41	0.06
Civet	1938-39	19,327	4.04	4,058.67	0.21	2.57
Civet	1939-40	15,641	3.89	3,910.25	0.25	2.93
Civet	1940-41	9,603	2.93	1,824.57	0.19	1.31
Civet	1941-42	7,836	2.48			no data
Civet	1942-43	4,958	1.66	1,784.88	0.36	1.26
Civet	1943-44	6,234	2.24	4,062.10	0.65	1.35
Coyote	1938-39	972	0.20	1,535.76	1.58	0.97
Coyote	1939-40	1,323	0.32	1,323.00	1.00	0.99
Coyote	1940-41	2,292	0.70	2,292.00	1.00	1.64
Coyote	1941-42	1,468	0.46			no data
Coyote	1942-43	1,806	0.60	6,393.24	3.54	4.53
Coyote	1943-44	2,349	0.84	12,308.76	5.24	4.13
Gray Fox	1938-39					no season
Gray Fox	1939-40					no season
Gray Fox	1940-41	438	0.13	569.40	1.30	0.40
Gray Fox	1941-42	1,141	0.36			no data
Gray Fox	1942-43	898	0.30	1,122.50	1.25	0.79
Gray Fox	1943-44	1,475	0.53	2,964.75	2.01	0.96
Mink	1938-39	2,887	0.60	17,466.35	6.05	11.10
Mink	1939-40	2,196	0.54	13,176.00	6.00	9.92
Mink	1940-41	2,272	0.69	16,721.92	7.36	12.03
Mink	1941-42	2,003	0.63			no data
Mink	1942-43	1,846	0.61	9,986.86	5.41	7.09
Mink	1943-44	3,775	1.24	36,240.00	9.60	12.25
Muskrat	1938-39	8,129	1.70	4,714.82	0.58	2.99
Muskrat	1939-40	6,450	1.10	3,870.00	0.60	2.91
Muskrat	1940-41	6,725	2.05	6,590.50	0.98	4.74
Muskrat	1941-42	6,638	2.10			no data
Muskrat	1942-43	7,810	2.61	8,591.00	1.10	6.10
Muskrat	1943-44	9,279	3.33	13,911.00	1.50	4.56
Opossum	1938-39	350,573	73.35	63,103.14	0.18	40.10
Opossum	1939-40	276,681	68.94	47,335.77	0.17	35.60
Opossum	1940-41	220,825	69.59	44,166.00	0.20	31.78
Opossum	1941-42	220,912	70.03			no data
Opossum	1942-43	222,903	74.75	53,496.72	0.24	37.99
Opossum	1943-44	182,310	65.49	85,685.70	0.47	28.67
Raccoon	1938-39	1,981	0.41	2,297.76	1.16	1.46
Raccoon	1939-40	2,318	0.57	2,252.10	0.96	1.69
Raccoon	1940-41	3,099	0.94	6,031.35	1.65	4.34
Raccoon	1941-42	3,226	1.02			no data
Raccoon	1942-43	3,350	1.12	6,901.06	2.06	4.90
Raccoon	1943-44	4,843	1.74	14,483.23	3.61	1.75
Red Fox	1938-39					
Red Fox	1939-40					
Red Fox	1940-41					
Red Fox	1941-42					
Red Fox	1942-43					
Red Fox	1943-44	86	0.14	436.88	5.08	0.13
Skunk	1938-39	92,948	19.44	63,203.64	0.68	40.17
Skunk	1939-40	95,862	23.88	60,093.06	0.63	45.28
Skunk	1940-41	80,564	24.63	59,617.36	0.74	42.90
Skunk	1941-42	71,443	22.65			no data
Skunk	1942-43	54,348	18.15	51,982.08	0.96	36.92
Skunk	1943-44	67,013	24.07	126,654.57	1.89	42.67

ANIMAL	YEAR	Total Pelts	Percent of Total	Approximate Value	Average Price Per Pelt	Percent of Total Retail Income
Wolf	1938-39	240	0.04	312.80	1.36	0.19
Wolf	1939-40	431	0.10	344.50	0.80	0.25
Wolf	1940-41	513	0.15	513.00	1.00	0.36
Wolf	1941-42	435	0.13			
Wolf	1942-43	243	0.08	366.93	1.51	0.26
Wolf	1943-44	282	0.03	848.00	3.00	0.28

TABLE XXVI
SUMMARY OF TABULATED FUR RECORDS FOR OKLAHOMA
1938-39—1943-44

Year	Total Pelts	Total Price Retail	Total Average of All Species Per Pelt
1938-39	477,318	\$162,352.70	.34
1939-40	401,242	132,598.16	.33
1940-41	326,895	143,161.28	.43
1941-42	315,393	142,201.89	.45
1942-43	298,146	140,004.54	.46
1943-44	278,297	297,105.62	1.06

PART II

ANALYSIS OF THE FUR DEALERS QUESTIONNAIRE

During July, 1944, a questionnaire was sent to some 300 licensed fur buyers in the state. This is the first attempt on the part of the Game and Fish Commission to study the opinion of the people in the fur-trade relative to questions of seasons and bag limits. Approximately 75 dealers replied, of which some 50 supplied usable data in full. The reaction on the whole was satisfying and an analysis of the replies is reported here.

QUESTIONS REGARDING LAWS

Two questions regarding season for taking fur-bearing species were submitted, one relative to primeness and the other, to the best time for taking furs with all factors considered. The problem was approached in this manner due to inquiries and criticism received in the past. However, all dealers treated these questions similarly and no distinction is made between the two questions in the analysis.

The question was stated, "When do you believe the following species of furbearing animals should be taken?"

- | | |
|-------------|-------------|
| 1. Badger | 7. Muskrat |
| 2. Bobcat | 8. Opossum |
| 3. Civet | 9. Raccoon |
| 4. Coyote | 10. Red Fox |
| 5. Gray fox | 11. Skunk |
| 6. Mink | 12. Wolf |

Nine separate seasonal conditions were suggested by the dealers (See Table XXVII). The results are treated by regions of the state to determine if effects of latitude on primeness of the furs entered into the problem.

The seasons suggested are shown in Table XXVII. The column **Mixed Season** represents those who suggested different legal seasons for separate species depending on when the species is in the best condition for taking.

It is seen that the bulk of the dealers favor a change from the present season. A total of 45% of the dealers favored a season from December 1 extending until February 1, consisting of opinions about equally divided between the north and south half of the state. However, 34 percent favored a mixed season or one in which the legal season varied as to when individual species are prime. Here however, the demand for mixed season came entirely from dealers in the northern half of Oklahoma. From these data however, it appears that a season extending from December 1 until February 1, would be most popular. Criticism against the present season extending from December 15 to February 15 consisted largely of the fact that many of the females are carrying young this late in the season. Only 8 percent favored the present season which, group however, represent third in rank on opinion. The other separate 6 opinions represented in the aggregate of 12 percent.

TABLE XXVII
SHOWING OPINION OF FUR BUYERS
AS TO ADVISABLE TIME FOR OPEN SEASON ON FUR-BEARING SPECIES

DATE OF SEASON	N. E. Dist.	N. W. Dist.	S. W. Dist.	S. E. Dist.	Total	Percent
Nov. 15-Dec. 15			1		1	2%
No. 15-Jan. 15	1				1	2%
Nov. 15-Feb. 1	1				1	2%
Dec. 1-Feb. 1	9	3	1	8	21	45%
Dec. 15-Jan. 15	1				1	2%
Dec. 15-Feb. 1			1		1	2%
Dec. 15-Feb. 15	2	1		1	4	8%
Jan. 1-May 1				1	1	2%
Mixed Season	6	10			16	34%
TOTAL					47	
Total Northern Half	20	14			34	
Total Southern Half			3	10	13	

THE MUSKRAT SEASON

Of those favoring a mixed season, muskrat was the principal species on which they wished to deviate from an over-all trapping period, which explains why this demand is confined entirely to northern Oklahoma. The bulk of these dealers favored a season on muskrat extending from January 1, to February 1, however, sufficient requests were available to allow this season to extend from December 15 to February 15. It appears from the questionnaire that a season from December 15 to February 15 would meet wider approval than having this species taken with the other fur species.

CLOSED SEASON ON LOW SPECIES

One question asked: "Are there any furbearers on which you believe a closed season should be placed?" The results are as presented below.

From these data it is believed that some further investigation should be done toward allowing for a regional closed season on raccoon. It is seen that 22 percent of the dealers favor such a closed season temporarily at least, with the bulk of the opinion from northeastern Oklahoma. Other species listed in this table do not appear to carry sufficient support for consideration of closed years.

TABLE XXVIII
SHOWING NUMBER DEALERS IN EACH DISTRICT FAVORING CLOSED SEASON
FOR SEPARATE SPECIES

SPECIES	NUMBER DEALERS				Total	Percent
	S. W. Dist.	S. E. Dist.	N. W. Dist.	N. E. Dist.		
Mink	0	2	2	2	6	10%
Red Fox	0	2	1	2	5	8%
Raccoon	0	2	2	9	13	22%
Muskrat	0	1	0	0	1	1%
Civet	0	0	0	1	1	1%
Gray Fox	0	0	1	2	3	5%
Skunk	0	0	0	1	1	1%

NOTE: A total of 29 dealers or 49 percent stated no species were in need of a closed season.

MISCELLANEOUS INFORMATION

Some miscellaneous data are available from the questionnaire. A summary of dealer opinion indicates that around 15 percent of the pelts marketed are classified as trash pelts, due largely to taking unprime furs, ignorance in handling and from torn pelts. A surprisingly large number of dealers requested **educational material** from the Game & Fish Commission on the proper technique of handling furs.

Dealers feel that around 25 percent of the state's furs are sold directly to mail order houses out of the state and are not recorded on the dealer reports.

SUMMARY

1. Dealer and trapper license revenue has declined since 1930. Reduction of dealer license fee from \$25.00 to \$15.00 reflected in reduction of revenue.
2. Civet, opossum and skunk pelts are gradually decreasing in numbers on the fur market, as shown since 1938-39. Civet and skunk both showed a slight recovery during the 1943-44 season after a continued decrease of 5 seasons.
3. Raccoon and coyote pelts are steadily increasing on the market.
4. Pelt sales have declined from 477,318 pelts in 1938-39 to 278,297 in 1943-44.
5. Due to gradual increase in the average price paid per pelt, total money received by trappers has remained about the same since 1938-39 until 1943-44 when the war fur prices greatly increased the total value of furs.
6. The most valuable fur producer in Oklahoma is the striped skunk. It accounts for 42.19 percent of the total value of furs.
7. The species marketed in greatest numbers is opossum which accounts for 70.16 percent of the pelts marketed.
8. The average price paid per pelt by lumping all species for each of the study years was 34c; 33c; 43c; 45c; 46c; and \$1.06.
9. Dealer opinion indicates fur seasons should be from December 1 extending to February 1, with the exception of muskrat which should be from December 15 extending to February 15.
10. Study should be started to collect data supporting regional closed seasons on raccoon and mink.

11. Approximately 15 percent of all furs marketed are trash pelts due to improper handling and unprime condition.
12. Around 25 percent of all pelts marketed are sold direct to out of state mail order houses.
13. Dealers express need for educational literature from Game and Fish Commission on proper technique for handling furs.

CONCLUSIONS

From this report it is seen that the fur industry demands much more administrative attention than has been given it in Oklahoma. There is need for a practical fur survey in order that management recommendations may be made. Under proper treatment the fur yield of an average Oklahoma farm can add importantly to the annual income of the farm boy and low income farmer.

Information needed is that which would benefit such species as mink, raccoon, striped skunk and civet in the general farm program. In addition, education on proper handling of furs would add much to the present worth of this industry to Oklahoma. Fur bearing species, as with other wildlife in Oklahoma are in need of some serious effort toward improving general habitat conditions with less thought to increasing populations by restocking and legislation.

PART III

THE FUR PRODUCTION OF GAME TYPES IN WOODWARD COUNTY OKLAHOMA

An attempt was made to gather information as to the productiveness of the game types in fur yield. Woodward County was selected for this study in northwest Oklahoma and due to the large amount of calculations necessary the work was discontinued before comparative data could be worked for other game types. The study of Woodward county is submitted here, with records of 177 trappers for 1938-39, 294 for 1939-40, and 171 for 1940-41 completed.

TRAPPER INCOME

Table XXIX shows the income classification for the trappers for Woodward county. The larger groups (78.28 percent) sold between \$0.15 to \$10.00 worth of furs each season; 13.45 percent sold between \$10.00 and \$20.00; 4.21 percent sold between \$20.00 and \$30.00 worth; and on up to the highest income group, accounting for 0.62 percent of the trappers and selling \$70.00 worth or more each year.

TABLE XXIX
INCOME GROUPS FOR ANNUAL FUR SALES IN WOODWARD COUNTY
 (Three-Year Average)

	\$0.15-\$10	\$10-\$20	\$20-\$30	\$30-\$40	\$40-\$50	\$50-\$60	\$60-\$70	\$70-\$80
Percent of total Trappers	.78.28	13.43	4.21	0.78	1.25	1.09	0.34	0.62

Table XXX shows the average income per trapper of each game cover type. The Stabilized-Dune Bottomland Type consistently shows a higher income average throughout the seasons, but the activities of one trapper from the Shinnery Game Cover Type brings that figure to exceed the others for 1940-41 season, as well as in the final three-year average. All game cover types show the 1940-41 season to yield a greater average income per trapper than the previous seasons.

schools. Too, for the Stabilized Dune and Shinnery Types a greater number of the trappers were found to be adults. On the Grassland Types, pelts of skunk and coyotes which visit the farm chicken house, are often the only ones sold on the market.

**COMPARISON OF PELTS MARKETED
 FROM GAME COVER TYPES
 WOODWARD COUNTY**

The species trapped in greatest numbers in Woodward County for the three seasons

TABLE XXX
**COMPARISON OF AVERAGE INCOME PER TRAPPER ON GAME COVER TYPES
 OF WOODWARD COUNTY**

GAME COVER TYPE	TRAPPING SEASONS			
	1938-39	1939-40	1940-41	3-Year Average
Stabilized Dune	\$9.13	\$8.52	\$15.51	\$10.86
Canyon-Eroded Mixed Grass	6.08	5.12	7.51	6.04
Sand-Sage Grassland	4.96	5.26	14.39	7.22
Post Oak Blackjack	5.41	4.83	12.49	6.21
Shinnery Grassland	5.95	5.28	2.28	11.02
County Average for 1938-39	\$ 6.53			
County Average for 1939-40	5.67			
County Average for 1940-41	13.14			
Three-year Average for county	7.22			

Some interesting incidental data were obtained relative to the percent of trappers operating on each game type, who trap every year. The Stabilized Dune Type here appears to support more trappers who trap every year. However, the Shinnery Type also shows a fairly high percentage operating consistently. The Grasslands Type showed no records of any trapper operating for three consecutive years. Here many of the trappers are boys who terminate their trapping activities when transferred to town

was the striped skunk. Of the total pelts marketed, 57.8 percent was of this species. Opossum accounted for 22.7 percent of the total pelts. Coyote and wolf pelts were lumped since there is much doubt as to whether the dealers can distinguish between the two animals. Wolf and coyote pelts were marketed as 8.45 percent of the total pelt sale; muskrat as 4.6 percent; and spotted skunk as 4.17 percent of the total. Raccoon, mink, badger and bobcat accounted for the rest.

TABLE XXXI
**PERCENT OF PELTS OF EACH SPECIES MARKETED IN WOODWARD COUNTY
 FOR THREE SEASONS**

Skunk	Opossum	Coyote & Wolf	Muskrat	Civet	Badger	Raccoon	Mink	Bobcat
57.8	22.7	8.45	4.61	4.17	0.76	0.04	0.02	0.01

COMPARISON OF NUMBER OF TRAPPERS FOR GAME TYPES

The canyon condition of the Grassland Type in northeast Woodward county supported the greatest number of trappers for the three-year period. Table XXXII shows this to be 29.28 percent of the total number. This Game Cover Type also occupies the greatest acreage in the county. The Stabilized Dune and Sand-Sage Types rank second in number of trappers with 25.07 percent each. In acreage the Sand-Sage Type occupies 30.72 percent of the county, while the Stabilized Dune Type occupies only 13.11 percent.

The Stabilized Dune Game Type ranked first in per cent of total number of pelts marketed, with 35.63 percent of the total pelts. The Mixed Grass—Eroded plains canyon condition of the Grasslands came second with 23.44 percent; and the Sand-Sage third with 21.18 percent. The Shinnery, Upland Woods-Post Oak-Blackjack Type and Grassland Types follow with 9.40 percent, 6.07 percent and 3.84 percent respectively.

In consideration of the value of the Game Cover Types per square mile in fur production, an allowance of twenty percent was made and included to approximate the total three-year fur sales. Table XXXIII shows the

TABLE XXXII
COMPARISON OF NUMBER OF TRAPPERS AND ACREAGE OF GAME TYPES
IN WOODWARD COUNTY

GAME COVER TYPE	Percent of Total Acreage	Number Trappers Used	Percent of Total Trappers
Canyon-Eroded Mixed Grass	8.00	88	29.28
Stabilized Dune	13.11	161	25.07
Sand-Sage Grassland	50.72	161	52.07
Upland Woods Post Oak-Blackjack	1.96	47	7.32
Shinnery Grassland	6.21	46	7.16
Grasslands (Agricultural)	10.00	39	6.07
Total Acreage—789,120			

The Stabilized Dune Type carried the highest number of pelts per trapper average for the county, with 16.70 pelts marketed per trapper. The Shinnery Type ranked second with 15.45 pelts per trapper. However, as with the average price, this figure is influenced by the great activity of one trapper as well as the small number of trappers for the Type.

Upland-Woods-Post Oak-Blackjack Type to produce the highest value per square mile of the type. This figure is \$4.73 per square mile per year average from the three-year study. The Stabilized Dune Type was valued at \$4.35 per square mile. Shinnery ranked third with \$2.63. The Sand-Sage, Canyon-Mixed Grass Eroded Plains Type and Grasslands Types follow with \$1.51, \$0.96, and \$0.70 per square mile respectively.

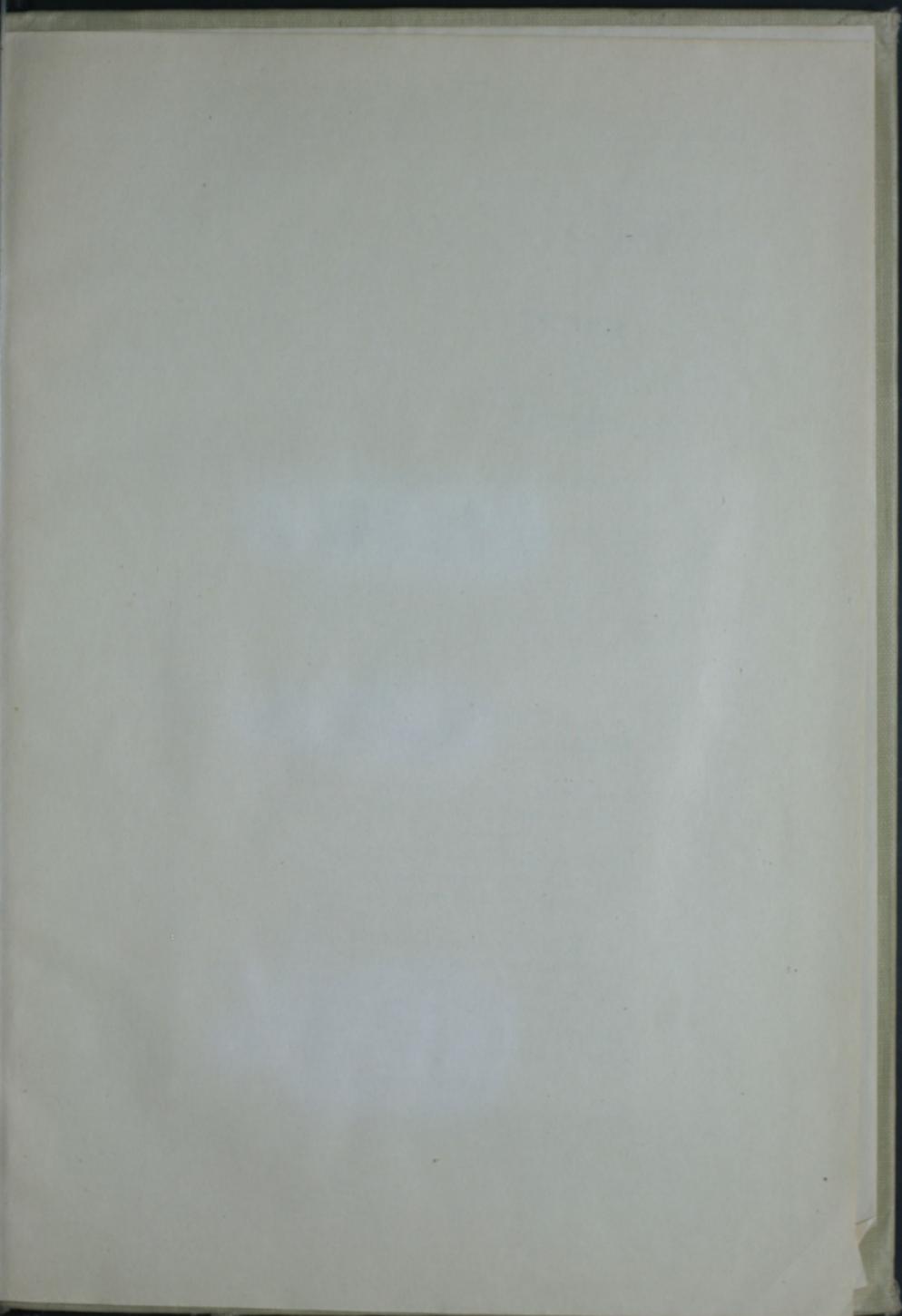
TABLE XXXIII
COMPARISON OF FUR SALES AND VALUE OF GAME COVER TYPES IN
WOODWARD COUNTY, OKLAHOMA

GAME COVER TYPE	Pelts Per Trapper	Percent of Total Pelts	Values of Types Per Square Mile per Season
Stabilized Dune	16.70	55.63	\$4.75
Shinnery Grassland	15.43	9.40	2.62
Sand-Sage Grassland	10.05	21.18	1.51
Post Oak-Blackjack	9.76	6.07	4.73
Canyon Eroded Mixed Grass	9.46	3.44	0.96
Grassland (Agricultural)	7.45	3.84	0.70

BIBLIOGRAPHY

- BENNER, F. C., CRAFTS, E. C., HARTMAN, THEO. C., and ELLISON, LINCOLN. 1938. A Selected Bibliography on Management of Western Ranges, Livestock and Wildlife. U. S. Dept. Agric., Misc. pub. No. 281.
- BENNETT, RUDOLPH, and NAGEL, WERNER O. 1937. A Survey of the Resident Game and Furbearers of Missouri. The University of Missouri Studies, Vol. XII., No. 2.
- BLAIR, W. F., and HUBBELL, T. H. 1938. The Biotic Districts of Oklahoma. The Amer. Mid. Nat. Vol. 20; 425-454, 1 fig.
- BRUNER, W. E. 1931. The Vegetation of Oklahoma. Ecol. Monogr., Vol. 1: 99-188, 21 figs.
- CARPENTER, J. RICHARD. 1940. The Grassland Biome. Ecol. Monogr., 10: 617-684, 7 fig.
- CLEMENTS, FREDERICK E., and SHELFORD, VICTOR E., 1939. Bioecology vii + 425 pp. 85 figs. New York, John Wiley and Sons.
- DALKE, P. D. 1937. The Cover Map in Wildlife Management. Jour. Wildlife Manag. Vol. 1: 100-105.
- 1941. Development of a Statewide System of Cover-Mapping Applicable to Missouri Wildlife Range. Jour. Wildlife Manag. Vol. 5: 103-109.
- DANIEL HARLEY A., and FINNEL, H. H. 1939. Climatic Conditions and Suggested Cropping Systems for Northwestern Oklahoma. Exp. Sta. Circ. No. 83, Agric. Exp. Sta., Okla. Agric. and Mech. College, Stillwater.
- DURRELL, GLEN R. 1939. Forest Trees of Oklahoma. Okla. Planning and Resources Bd., Div. Forestry, Pub. 1, Revised ed. 5.
- FENNEMAN, NEVIN M. 1931. Physiography of the Western United States xiii + 534 pp., 173 figs. 1 folding map. New York, McGraw-Hill Book Co.
- 1938. Physiography of Eastern United States. xiii 714 pp., 7 pls., 197 figs. New York, McGraw-Hill Book Co.
- FINNEL, H. H. 1929. Sorghum Crops on the High Plains of Oklahoma. Exp. Sta. Bull. No. 191, Okla. Agric. and Mech. Coll., Agric. Exp. Sta., Stillwater.
- FOREMAN, GRANT 1937. Adventures on Red River. A Journal of Capt. R. B. Marcy. Univ. of Okla. Press, Norman.
- 1939. Marcy and the Gold Seekers. Univ. of Okla. Press, Norman.
- GAINES, STANLY H. 1938. Bibliography on Soil Erosion and Soil and Water Conservation. U. S. Dept. Agric. Mucs. pub. No. 312.
- GRAHAM, EDWARD H. 1940. Ecology and Land Use. U. S. Dept. Agric. Soil Conserv. Serv. Soil Conservation Vol. vi, No. 5.
- HOLT, ERNEST G. 1930. The Wildlife Conservation Program of the Soil Conservation Service. SCS-AR-3. U. S. Dept. Agric., Soil Conserv. Serv.
- JOEL, ARTHUR H. 1937. Soil Conservation Reconnaissance Survey of the Southern Great Plains Wind-Erosion Area. U. S. Dept. Agric., Tech. Bull. No. 556.
- KELLOGG, ROYAL S. 1905. Forest Belts of Western Kansas and Nebraska. U. S. Dept. Agric., Forest Serv. Bull. No. 66.
- LEOPOLD, ALDO. 1931. A Report on Game Survey of the North Central States. Am. Game Assoc.
- 1933. Game Management. Chas. Scribner's Sons, New York.
- MCDONALD, ANGUS. 1938. Erosion and Its Control in Oklahoma Territory. U. S. Dept. Agric. Misc. Pub. No. 301.
- OSBORN, BEN, and WHITAKER, H. L. 1936. Legend for Reconnaissance Mapping of Natural Vegetation in the Central Great Plains Region. U. S. Dept. Agric., Soil Cons. Serv., Region 7, Salina, Kans. Biol. leaf No. 9.
- 1937. Reconnaissance Mapping of Natural Vegetation of the Central Great Plains Region. U. S. Dept. Agric., Soil Conservation. Serv., Region 7, Salina, Kans. Biol. leaf. No. 12.
- 1937. Significance of Natural Vegetation in Planning Erosion Control and Wildlife Management. U. S. Dept. Agric., Soil Conserv. Serv., Region 7, Salina, Kans., Biol. leaf. No. 11.
- 1937. Chart of Principal Dominant Species for Determination of Types and Phases of Natural Vegetation in the Central Great Plains Region. U. S. Dept. Agric., Soil Cons. Serv., Region 7, Salina, Kans. Biol. leaf. No. 10.

- PHILLIPS, JOHN C. 1928. Wild Birds Introduced or Transplanted in North America. U. S. Dept. Agric. Tech. Bull. No. 61.
- ROWALT, E. M. 1938. Soil Defense in the South. U. S. Dept. Agric. Farmers Bull. No. 1809.
- RYDBERG, PER AXEL. 1932. Flora of the Prairies and Plains of Central North America. New York Botan. Gard.
- SHANTZ, H. L. 1923. The Natural Vegetation of the Great Plains Region. Annals Assoc. Amer. Geographers, Vol. 13: 81-107.
- , and ZON, RAPHAEL. 1924. Natural Vegetation. U. S. Dept. Agric., Atlas of Amer. Agric.
- STEMAN, THOMAS. R., and MYERS, W. STANLEY. 1937. Oklahoma Flora. Harlow Pub. Co., Okla. City.
- STODDARD, HERBERT L. 1941. The Bobwhite Quail, Its Habits, Preservation and Increase. Chas. Scribner's Sons, New York.
- TURNER, L. M. 1935. Notes on Forest Types of Northwestern Arkansas. Amer. Midl. Natur. Vol. 16: 417-421.
- UNITED STATES DEPARTMENT OF AGRICULTURE. Bureau of Chemistry and Soils. Soils Survey (Reports for Okla.)
- . Biotic Surveys (Natural Vegetation and Wildlife). TEC-379-39 (Manuscript) Reg. Biol. Div., Soil Conserv. Serv., Region 4, Ft. Worth, Tex.
- . Soils and Men. 1938. U. S. Dept. Agric. Year Book.
- . Climate and Man. 1941. U. S. Dept. Agric. Year Book.
- . 1940. Wildlife Handbook. Forest Serv., No. Cen. Region, Milwaukee, Wisc. Revised ed.
- UNITED STATES GEOLOGICAL SURVEY. A 1926 Geologic Map of Oklahoma. Compiled by Hugh D. Miser.
- VAN DERSAL, WILLIAM. 1939. Native Woody Plants of the United States, Their Erosion-Control and Wildlife Values. U. S. Dept. Agric. Misc. Pub. No. 303
- WEAVER, S. R., and CLEMENTS, FREDERICK E. 1929. Plant Ecology. 520 pp. frontispiece, 262 figs. New York, McGraw-Hill Book Co.
- WEBB, W. L. 1940. A Method for Wildlife Management Mapping. Unpub. MS. Masters Thesis, Univ. of Minn.
- WIGHT, H. M. 1934. The Cover Map and Game Census in Phaesant Management. Trans. 20th Amer. Game Conf., pp. 334-339.
- . 1938. Field and Laboratory Technique in Wildlife Management. Univ. of Mich. Press, Ann Arbor, 107 pp.



OKLAHOMA LIBRARY COMMISSION
TRAVELING LIBRARY

129 24

139324

May 10 '47

OKLAHOMA LIBRARY COMMISSION
TRAVELING LIBRARY

139324

139324

LIBRARY CARD—DATE DUE RECORD

BOOK NO. _____

DATE OUT	DATE RETURNED	DATE OUT	DATE RETURNED
DEC 2 1955			
JAN 6 1963			

**FREE
TRAVELING LIBRARIES**

Oklahoma Library Commission
State Capitol, Oklahoma City

BOOKS FREE—Use of books is free to any responsible person in the state upon receipt of his application card signed by a guarantor.

BORROWERS—Borrowers are held responsible and must pay for lost or damaged books.

POSTAGE—Postage to and from the Library Commission must be paid by borrowers.

LOANS—Length of loan and number of books can be adjusted to meet the needs of the borrowers.

