

GAME SURVEY OF INDIANA
by
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A Copy Of

Report on a Game Survey of

INDIANA

Submitted to the Game Restoration Committee

Sporting Arms & Ammunition Manufacturers' Institute

By

Aldo Leopold

June 15, 1929

GAME SURVEY OF INDIANA

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PREFACE

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Page or Table

I. DESCRIPTION

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| | No map of original forest. Much savanna or broken prairie. Can't classify like Illinois types. | | |
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Soil very spotty. Game differs. Unlike Ohio Lake Bottom. | | |
| | b. New Glaciated Prairie. Lighter--often underlain by sand. Osage. Marshes drained. (No larger prairie on the older or Ill. Glac) | | |
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Mint--relation to drainage
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Gravel & Stone Pits. | | |
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Lake Region--pheasant, quail, rabbit, prairie chicken, Hungarian.

Prairie--rabbit, (prairie chicken & pheasant if refuges).

Till Plains--quail, Hungarian, (pheasant & prairie chicken if refuges), rabbit.

Illinoian Drift--quail, rabbits, (prairie chicken along Wabash if refuges).

Unglaciaded Hills--quail, turkey, rabbit.

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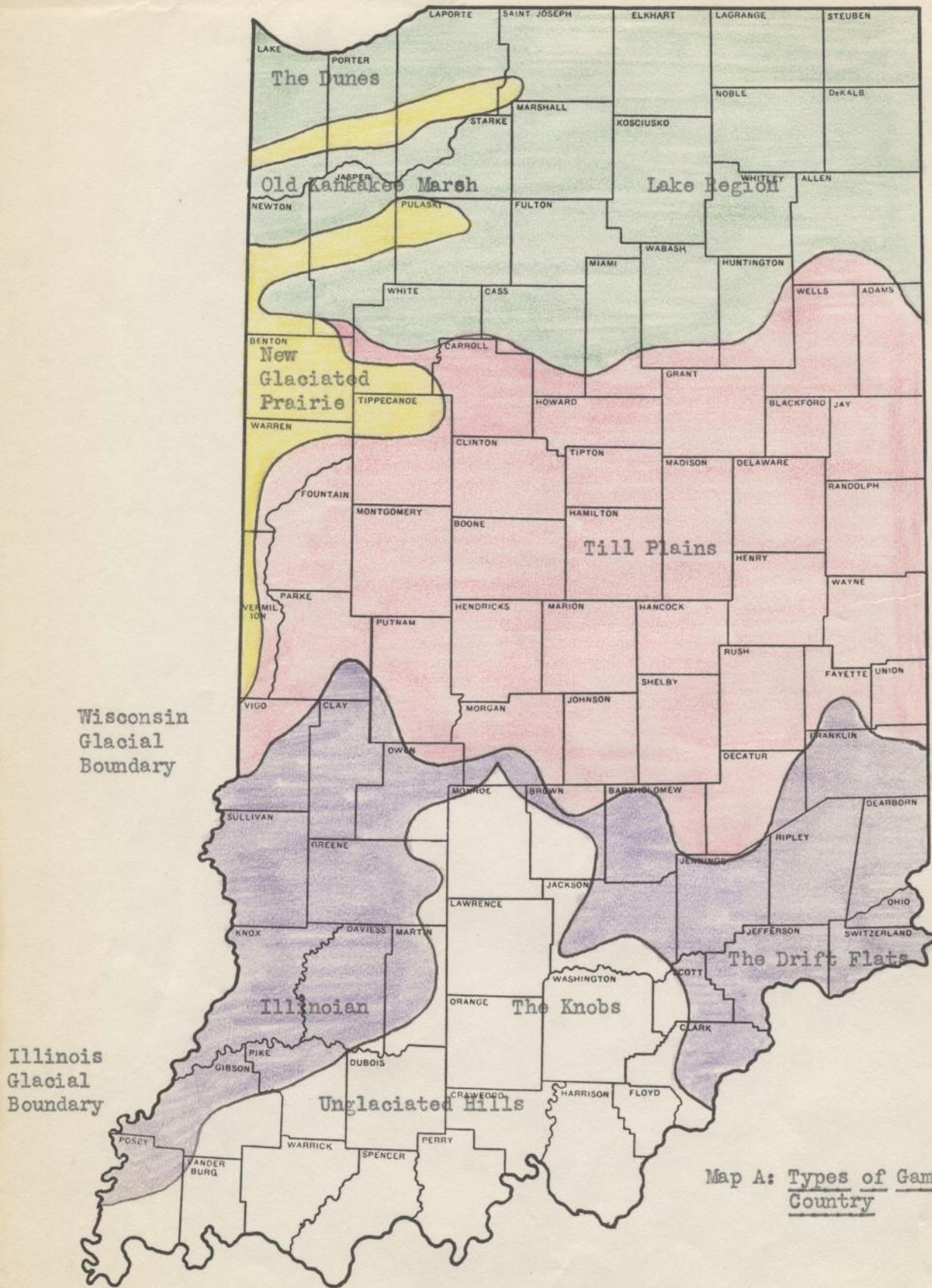
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Map A-1

Glacial Map of Indiana



Map A: Types of Game Country

I. DESCRIPTION

1. Types of Game Country. For game purposes Indiana may be classified as follows:

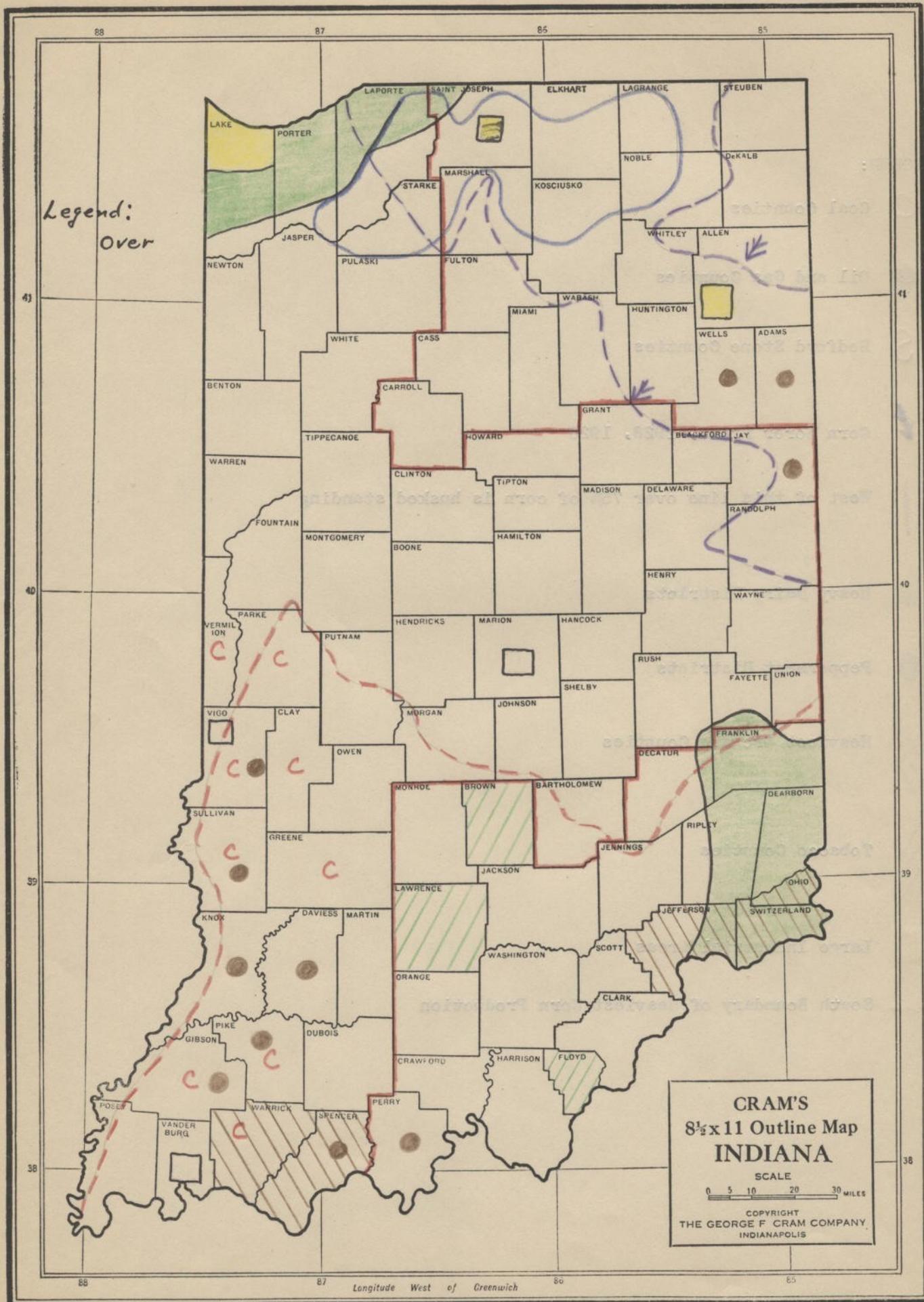
<u>Type</u>	<u>Area, Acres</u>	<u>Area Square Miles</u>	<u>Percent</u>
1. Lake Region	4,480,000	7,000	19
2. New Glaciated Prairie	960,000	1,500	4
3. Till Plains	9,184,000	14,350	40
4. Illinoian Drift	4,800,000	7,500	21
5. Unglaciated Hills	3,840,000	6,000	16
	23,264,000	36,350	100

Map A shows these types. There were many small prairies in Indiana which have never been mapped and which hence can not be shown. Accordingly the classification of types proceeds on soil and topography as in Ohio, instead of soil topography and an exact map of original forest as in Illinois.

2. Indiana Soils. As in the neighboring states, soil seems to control abundance and kind of game, not only indirectly through agriculture, but directly through factors as yet unknown. It is, therefore, important to set forth at the outset a general picture of Indiana soils.

The whole state, except Type 5, derives its soils from the eastward-flowing ice sheet which once covered Types 1 to 4. There is no soil map of the entire state, but only detailed maps for some counties, but one point is clear from ordinary observation; the loose blanket which covers the glacial drift throughout most of Illinois is almost absent from Indiana, except possibly along the Wabash and the southern tip of the state. Hence the game birds depending

Map B: Crops And Industries Affecting Game



Legend:
Over

GRAM'S
8 1/2 x 11 Outline Map
INDIANA
SCALE
0 5 10 20 30 MILES
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THE GEORGE F. GRAM COMPANY,
INDIANAPOLIS

Longitude West of Greenwich

LEGEND:



Coal Counties



Oil and Gas Counties



Bedford Stone Counties



Corn Borer Front, 1928, 1926



West of this line over 75% of corn is husked standing



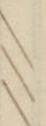
Heavy Dairy Districts



Peppermint Districts



Heaviest Orchard Counties



Tobacco Counties



Large Industrial Areas



South Boundary of Heaviest Corn Production

CRAY'S
6x11 Outline Map
INDIANA
SCALE
THE GEORGE F. CRAY COMPANY
INDIANAPOLIS, IND.

Legend
Over

on the exposure of drift soils present a simpler problem. Map A, compiled by Indiana University, shows the glacial moraines in a manner similar to Leighton's Map G for Illinois. The particular character of the soils in the various types of game country is brought out in Caption 3.

3. Description of Types. The Lake Region occupying the northern part of the state is similar to the Lake Region of Illinois in consisting of plain interspersed with irregular gravel hills representing glacial moraines and covered with oak forest. Unlike the Lake Region of Illinois, however, the Indiana Lake Region is characterized by frequent sand dunes. These increase in frequency as it approaches Lake Michigan.

The plain interspersed with the moraines is like Illinois in having a black soil, frequent small prairies, and many marshy lakes, but the soil is sandier and more frequently peaty. Many of the swamps are filled with tamarack. There is less tendency for the grazed swamps to form hummocks than in Illinois. As in Illinois, most of the swamps have been drained.

The soil throughout this region is very spotty, several kinds often occurring within a single forty.

The Lake Region is entirely unlike the region which lies to the eastward in Ohio, which comprises the bottom of the glacial lake Maumee, and which has heavy soils unbroken by moraines or swamps.

The New Glaciated Prairie is similar to the same type in Illinois, but the soil is lighter and often underlain by sand. As in Illinois, the only game cover is standing corn and osage hedges.

The Till Plains are like the same type in Ohio, but have fewer swampy rivers and hence are poor pheasant country.

There is no type in Indiana corresponding to the Old Glaciated

Prairie in Illinois.

Type 4, which for lack of a better name has been called the Illinoian Drift, is not uniform. On the west along the Wabash it resembles the Old Glaciated Prairie of Illinois. Toward the east where underlain by limestone it resembles the bluegrass country of Ohio and Kentucky, but where underlain by shale it resembles the glaciated hills of eastern Ohio.

The Till plains and Illinoian Drift are characterized by a heavy proportion of beech and maple in the forest cover.

Type 5 corresponds to the unglaciated hills of Ohio, but in Indiana this type is popularly called "the knobs." The soils are possibly poorer than the loose soils found in the unglaciated part of Illinois, but not as poor as the shale soils of unglaciated Ohio. This fact bears on the carrying capacity for game.

4. Crops and Industries Affecting Game. Map B shows the location of some of the crops and industries affecting the possibilities of game production.

Indiana stands intermediate between Illinois and Ohio in the degree to which agricultural practices control cover, and hence the game supply. It is the state, for instance, where the Illinois practice of leaving the corn stand over winter shades off into the Ohio practice of cutting and shocking the corn in fall. The most important single game question in Indiana is whether the spread of the corn borer will change this agricultural custom. As shown by Map B this pest is rapidly invading northern Indiana. The only vulnerable stage in the life cycle of the corn borer is its habit of wintering in the corn stalk. Agricultural authorities have fallen back upon burying of corn stalks as the only feasible means of control. If this means that all of the corn will eventually have to be cut in the

fall it will radically reduce the game carrying capacity of Indiana farms. If it proves sufficient to plough under the stalks in spring the present situation will not be materially changed.

State Entomologist Wallace gives it as his opinion that careful spring ploughing is technically sufficient as a means of controlling the corn borer, but he also states that spring ploughing is humanly impracticable, because of the rush of work on the average farm in spring. He therefore anticipates the necessity of cutting corn stalks and possibly also ploughing them under in fall. No other single future development is of equal import to game conservation.

Agricultural intensification is eliminating the osage hedge from western Indiana in the same manner as in Illinois. This trend in conjunction with the corn borer is liable to make the prairie type a gameless country, unless refuges can be established to retain some pheasants and prairie chickens.

In the Lake Region a great deal of peppermint is raised for distillation for peppermint oil. This profitable crop thrives on lands too sandy and peaty for other crops and hence has induced the drainage of many swamps which formerly furnished excellent game cover.

Coal and oil lands seem to suffer a decline of game productivity, the additional resulting from idle farms being about offset by the character of human populations induced by coal and oil development and by the diminution of grain fields.

The stone and gravel industries deserve mention as an important factor in future game crops. Gravel pits and quarries upon abandonment become either excellent fishing lakes or brush patches, or both. These places are becoming sufficiently numerous to be important.

It is obvious, of course, that the industrialization of the Chicago area in northwestern Indiana has placed a heavy drain on game crops in that part of the state. The problem of abandoned farm lands is reserved for discussion in Section B of this report.

5. Suitability of Types for Game. The important game crops of the Lake region are pheasant, quail, rabbit, and prairie chicken, in the order named. This ought to be very suitable ground for Hungarian-partridge, but for some reason as yet entirely obscure they thrive only in one county (see Map F). The future possibilities of pheasants in this region are somewhat uncertain because of an unsettled question as to whether their present lack of abundance is due to insufficient stocking or unsuitable ground. The future of both pheasants and prairie chickens would be greatly enhanced by the installation of marsh refuges. Waterfowl can be restored to this region on a large scale by the restoration of the Kankakee marshes and the installation of refuges and improvement of feeds in the existing lakes.

The future game of the prairie region will be rabbits only. A limited supply of prairie chickens and pheasants can be added if marsh refuges are installed.

The future game of the Till Plains is quail, Hungarian partridge (eastern part), pheasant, prairie chickens (if marsh refuges established) and rabbits.

The future game of the Illinoian Drift is quail and rabbits, with possibly a few prairie chickens along the Wabash if marsh refuges are installed.

The future game of the Unglaciaded Hills is quail, turkey and rabbit.

In order to furnish a basis for future calculations on the volume of possible game crops the following caption contains an estimate of the present and potential acreage suitable for each species within the state.

6. Acreage of Present and Estimated Potential Range by Species

<u>Species</u>	<u>Type or Part of Type</u>	<u>Range, Acres</u>		<u>% of State</u>
		<u>Present</u>	<u>Potential Additional</u>	
<u>Quail</u>				
Present -	1/4 of Lake Region	1,100,000		
	1/20 of Prairie	50,000		
	1/3 of Till Plain	5,000,000		
	1/3 of Illinoian Drift	3,400,000		
	1/3 of Unglaciaded Hills	1,900,000		
		<u>10,450,000</u>		.45 . 45
Potential	1/4 of Till Plain, Ill. Drift & Unglaciaded Hills		4,500,000	.. <u>20</u> 65
<hr/>				
<u>Pheasant</u>				
Present -	1/10 of Lake Region	500,000		
	1/10 of Till Plain	1,000,000		
	1/20 of Illinoian Drift	250,000		
		<u>1,750,000</u>	 7
Potential ?			?	<u>?</u> ?
<hr/>				
<u>Hungarian</u>				
Present -	1/20 of Lake Region	225,000		
	1/10 of Till Plain	1,000,000		
		<u>1,225,000</u>	 5
Potential --	doubling used area within present range		1,225,000	.. <u>5</u> 10
<hr/>				
<u>Prairie Chicken</u>				
Present -	1/20 of Lake Region	225,000		
	1/20 of Prairie	50,000		
		<u>275,000</u>	 1
Potential . . ?			?	<u>?</u> ?
<hr/>				
<u>Wild Turkey</u>				
Present -	practically none		0 0
Potential --	1/10 of Unglaciaded Hills		380,000	<u>2</u> 2

II. ANALYSIS

(A) The Game Situation in Indiana

7. Summary. As in Illinois and Ohio, quail are by far the most important and valuable game resource, - the more so by reason of the lack of evidence that pheasants will thrive, and the very positive evidence that Hungarians are adapted to only a small proportion of the state. No very heavy quail populations were found, but a good stock of quail is widely distributed; in fact there is less blank territory in Indiana than any state so far surveyed.

There is a scattering of pheasants over all the drift soils, but there is no definite prospect of widespread abundance as in Ohio and northeast Illinois.

Hungarians are thriving in east-central Indiana but not elsewhere.

Rabbits are doing well and show the occasional spotty shortages which seem characteristic of the cornbelt.

There is a seed-stock of prairie chicken which could be expanded by providing swamp coverts.

Turkey could be restored to the southern hills through a proper system of state forests and refuges.

Waterfowl shooting is almost a thing of the past, in spite of the many lakes. Refuges and marsh-restoration could bring them back.

By and large, the future of game in Indiana will be determined by what is done in the next five years. Under a continuance of the present system of merely regulating seasons and planting seed stock, the ultimate closure of everything but pheasants and rabbits is more than probable.

On the other hand, if two problems can be solved, namely:

(I) The problem of farmer-relations:

(2) The problem of deliberately improving game environments:

there is every reason to hope for a large increase in quail, the opening and increase of Hungarians, the perpetuation of the prairie chicken, and the restoration of waterfowl and wild turkey.

The solution of both these problems hinges upon:

- (a) Getting the facts on the environmental relations of each species.
- (b) Setting up a workable mechanism which will induce farmers to apply those facts, i.e. to raise game crops.
- (c) Public acquisition of refuges and shooting grounds for the species adapted to such treatment (pheasant, prairie chicken, turkey).

While the aggregate activity devoted to game matters in Indiana is enormous (larger than either Ohio or Illinois), and while the organization of state leadership is essentially sound (in contrast to both Illinois and Ohio), nothing is being done which aims directly at the accomplishment of any of these three essential moves, except a very small start on (c). All of the available energy is expended in non-essential moves and routine activities.

Lest this statement sound unduly harsh or critical, I will say that the same is true of all the other states surveyed except Michigan, which is attacking items (b) and (c).

8. Quail

Map C shows the information on quail and rabbits which can be reduced to map form.

History and Present Status of Quail. No effort was made to determine the history of quail from the literature. Undoubtedly Indiana originally was intermediate between Ohio, which had no quail, and Illinois, which probably had quail all along the border of the

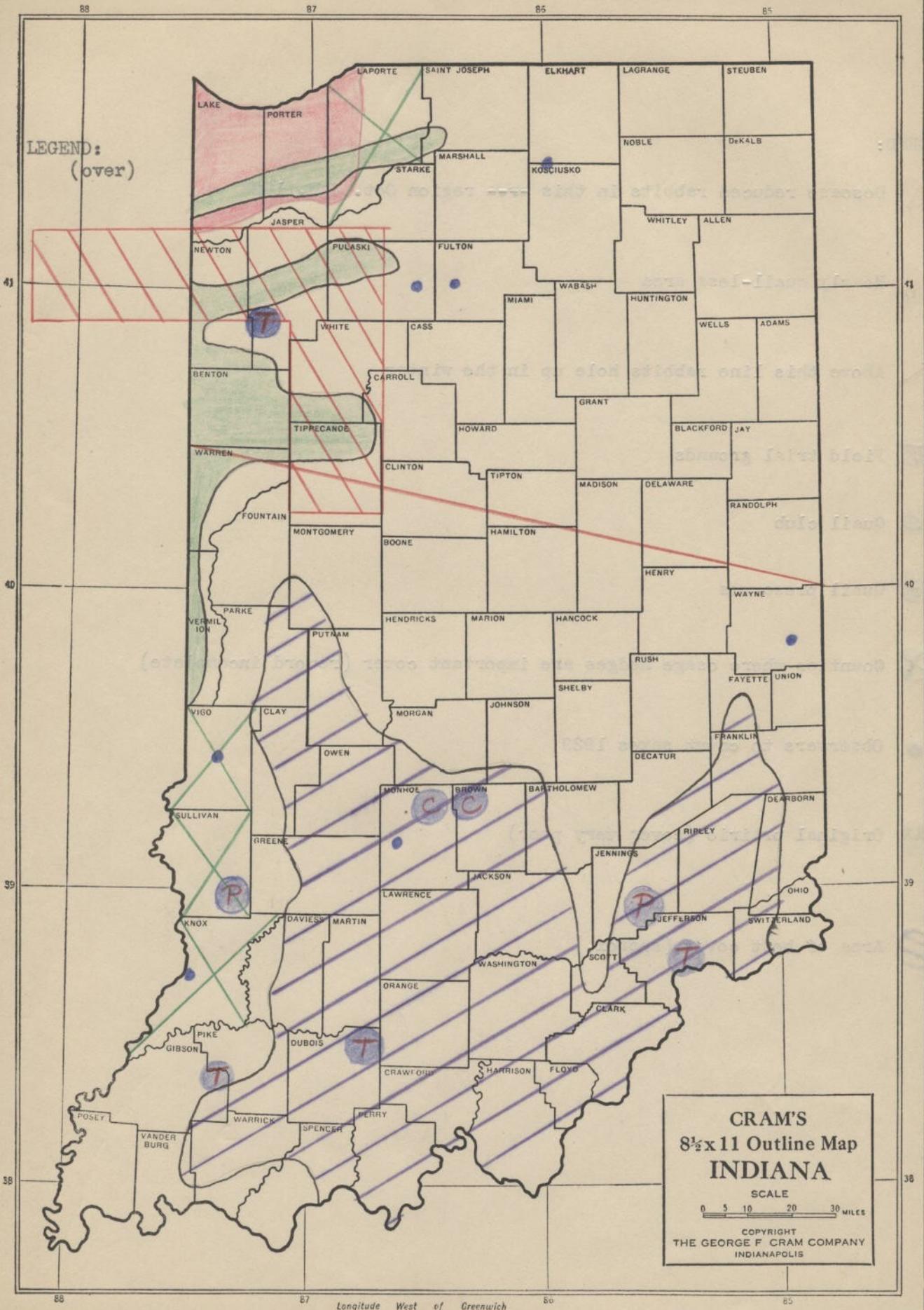
prairies. As in the adjoining states, there was undoubtedly an enormous increase of quail with the introduction of clearing and crude agriculture, followed in turn by a decrease with the intensification of agriculture and the consequent removal of coverts. Quail are now of approximately uniform abundance throughout the state, except that they are scarce in the northwestern part of the Lake region and in the Glaciated Prairie. There are also probably less quail in the central part of the Till Plains, but this difference is much less pronounced.

It may, in fact, be said that there is a nearly quail-less area, including Lake, Porter, and western LaPorte counties, down to the breaks of the Kankakee in Indiana, and including also Kankakee, Will, Cook, Lake, McHenry, and the northern part of Boone county, Illinois. In the Illinois report the abundance of pheasants on the Illinois end of this region was suggested as a possible cause for the abundance of quail, but this probability breaks down entirely in view of the nearly total absence of pheasants in the quail-less area of Indiana. The cause of this quail-less area must be left for the present as entirely obscure. Sportsmen ascribe it to the heavy hunting adjacent to the industrial districts of Chicago, but this reason breaks down because of the extreme abundance of quail in suburban areas elsewhere. It is important to determine the reason for the quail-less area, not only with the view to restoration within the area, but because of the light which may be shed on the fundamental requirements of the species throughout its range.

That the quail-less condition actually exists was indicated by census in the Illinois report, and the following data can now be added:

MAP C: Quail & Rabbits

LEGEND:
(over)

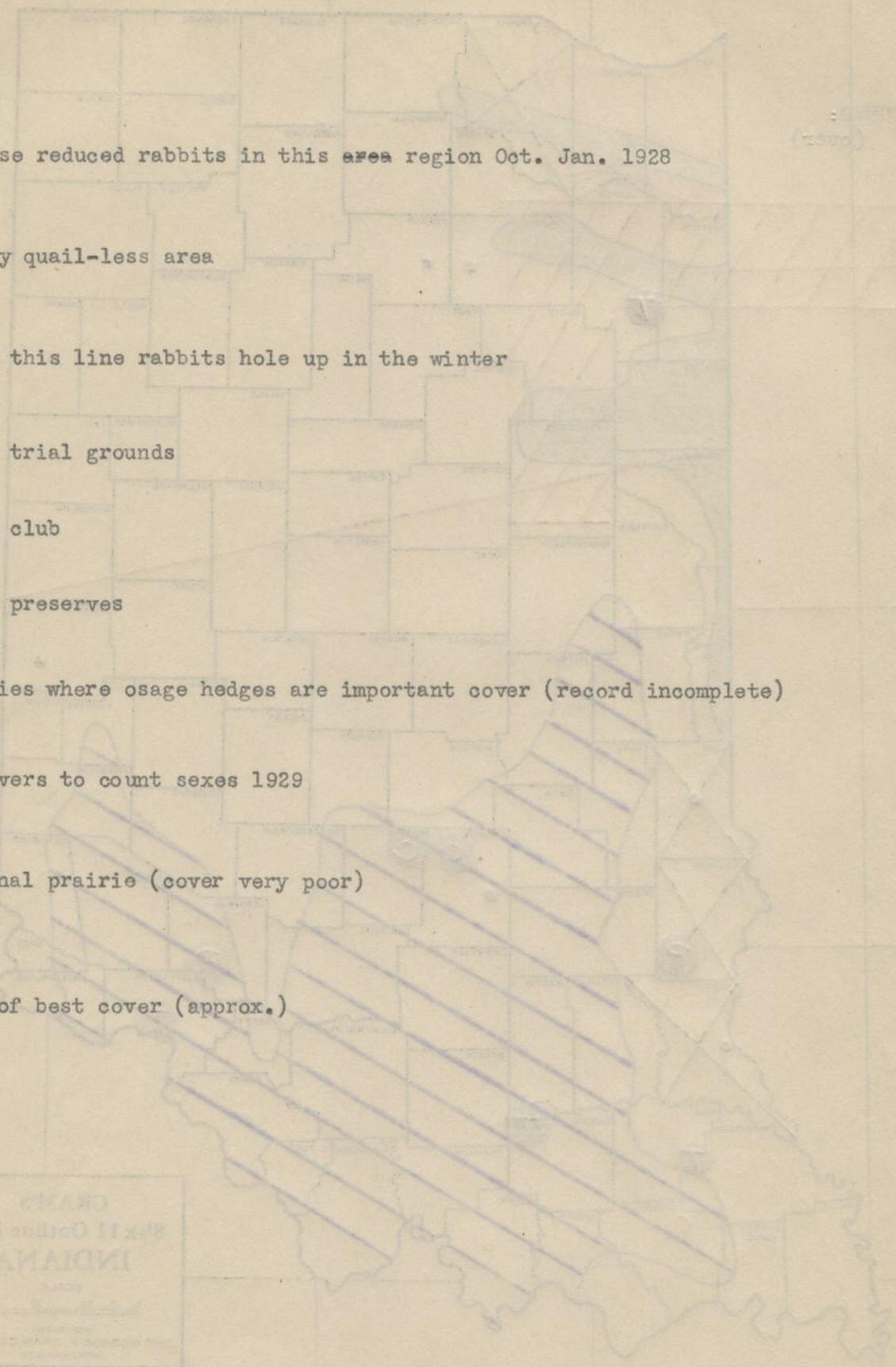


CRAM'S
8½x11 Outline Map
INDIANA
 SCALE
 0 5 10 20 30 MILES
 COPYRIGHT
 THE GEORGE F. CRAM COMPANY
 INDIANAPOLIS

LEGEND:

-  Disease reduced rabbits in this area region Oct. Jan. 1928
-  Nearly quail-less area
-  Above this line rabbits hole up in the winter
-  Field trial grounds
-  Quail club
-  Quail preserves
-  Counties where osage hedges are important cover (record incomplete)
-  Observers to count sexes 1929
-  Original prairie (cover very poor)
-  Area of best cover (approx.)

CRAYS
 8/11 Collins Map
 INDIANA
 1928
 THE UNIVERSITY OF CHICAGO PRESS
 CHICAGO, ILL.



<u>Observer</u>	<u>County</u>	<u>Abundance</u>
Blodgett	Kankakee	No quail whatever
Siepel	Will	1 covey per 2 farms
Wark	Porter	1 covey per 10 farms
Powell	Porter	1 covey per 10 farms north of Kankakee region

Miscellaneous whom I question in Lake County, without recording their name or address, told me there were hardly any quail. By the time one reaches LaPorte County estimates of 1 covey per 4 farms are encountered

Populations and Kills. Table D contains the more reliable census and quail figures gathered in Indiana. Table D1 is a miscellaneous collection of rough figures in terms of coveys per day and coveys per farm.

No exceptionally heavy quail populations such as reported on the Alton tract and the Karraker tract in the Illinois reports were encountered in Indiana. Table D contains mostly large tracts which are, of course, not directly comparable to the small Illinois tracts above mentioned. Nevertheless I have the firm impression that the maximum populations on small tracts are greater on the best of Illinois than on the best of Indiana, and that this somehow reflects the character of the environment. Possibly the loose soils along the Mississippi actually constitute the best quail country in the United States.

One fact was perfectly clear from the impressions and figures gathered in field work: there is less blank quail land in Indiana than in any state so far visited. I also gathered the very strong impression that quail in the heavily hunted parts of Indiana are holding up somewhat better than in the heavily hunted parts of Illinois, and this may be due to the fact that the removal of coverts.

Table D
Quail Census & Kill Data--Ind.

Observer-Place County	Acre- age	Year	Population Covies	Per Covey	Birds	Acres Per Bird	Kill	Acres Per Bird	Per Cent
Frank N. Wallace Albert Wallace Farm Martinsville, Morgan Co.	40	17yr	2-3	15	40	1.0	Never shot (many foxes)		
(All orchard except 10 acres brush and 6 acres pasture. 25-30 usually survive winter.)									
D. A. Dunlevy J. W. Russell Farm Henryville, Clark Co.	100	5 yrs.	4	15	60	1.6	Not known, hunted some		
(This is the birdiest farm in this section)									
John Greyerson Training Grounds Jefferson & Ripley Cos.	6000	1927	80	12	960	6.2	?		
(This is better than average ground for S. Ind.; 1927 a good year)									
John Greyerson Part of above Jefferson & Ripley	640	1927	11	12	132	4.8	?		
(This was the best section of the 6000 acres)									
John Greyerson Part of above Jefferson Co.	20	1927	6	12	72	0.3	?		
(This was the best spot of the 6000 acres; shows influence of size of area on census figures)									
H. D. Newsome Jesse Newsome Farm Bartholomew Co.	470	1928	5	10-35	60	7.8	Not hunted		
(1927 same or a few more. This is creek bottom and near average)									
Frank Gentry 1 sq. mi. NE of house (hills) Brown Co.	640	1928	20	20	400	1.6	150	4.2	37
(Never less than 100 birds killed on this section last four years)									
Frank Gentry 1 sq. mi. SW of house (bottoms) Brown Co.	640	1928	40	20	800	0.8	200	3.2	25
(Never less than 150 birds killed on this section last four years)									
John H. Gude 1 sq. mi. just W Bruce- ville, Knox Co.)	640	1928	11	15	165	4.0	?		
(This section had 15 covies 1927. 6-7 in poorest yrs. Is sample of best ground)									
R. E. Llewellyn Edgewood Grove Vigo. Co.	100	1928	5	15	75	1.2	?	Hunted	
(This suburban real estate. Is sample of heaviest stocking)									
R. E. Llewellyn ? Parke Co.	200	1928	5	12	60	3.5	?		
(This is better than average for the county)									
Fred C. Dobelbower Guy VanMetre Farm Warren Co. (5 mi. NE Williamsport	475	1920	1	6	6	79	?		
		1928	?	?	174	2.7	32	15.0	18
(This is a very careful census, made on Jan. 9 after about 32 birds had been killed. Owner conserves cover and winter feeds. Many foxes; no control. Sample of best ground)									

Table D (Contd)
 Quail Census and Kill Data-- Indiana

Observer-Place County	Acre- age	Year	Population Covies Per Covey	Birds	Acres Per Bird	Acres Kill Per Bird	Per Cent
M. L. Neeley J. P. Doty Farm West Marion Co.	200	1927	3	15 45	4.5	?	(Also 1 covey of Hungarians. This is a sample of the best quail ground.)
Wm. Wugeman Outskirts of Ft. Wayne Allen Co.	160	1928	5	15 75	2.1	?	(This sample of the best ground)
Dr. Geo. Hunt N.E. Wayne Co.	640	1928	8	15 120	5.0	?	(This is a sample of the best ground in the county, along creek)
John Goodrich Suburbs of Winchester Randolph Co.	640	1928	6	15 90	7.1	?	(This is a sample of the best ground in county. Suburban real estate)
George Cass Suburbs of Nappanee Elkhart Co.	5000	1928	20	15 300	16	?	(This is his training ground, was thoroughly worked. Average or better)
Geo. W. Smith, Jr. Farm near Kewanna Fulton Co.	600	1928	6	15-50 100	6.0	?	'22or'23 10 150 4.0 (This is his own farm. Better than average ground for this region)
Don Wright and Ray Smith Rennselaer Field Trials Jasper Co.	740	1928	8	15 120	6.2	?	(This is the best ground in the county.)

Table D 1

Estimated Quail Covies Per Average Farm & Flushed Per Day.

<u>Observer</u>	<u>County</u>	Indiana		<u>Quail</u> <u>15</u>	<u>Acres</u> <u>Per Quail</u>	<u>Covies</u> <u>Per Day</u>
		<u>Size</u> <u>Farm</u>	<u>Covies</u>			
V. O. Keith	Shelby	160	1	15	10	(maybe less birds than this)
John Vandewalle	Jackson					5-8
D.A. Dunlevy	Clark					5-7
Frank Gentry	Brown					7-8 per $\frac{1}{2}$ day, best land
Arthur Murray	Sullivan	700 (poor, coal land)	4	60	11	
Arthur Murray	Sullivan	600 (best)	5	75	8	
M. L. Neeley	Grant	140	3/4	12	12	
Ivan Pressler	Tipton	140	1/2	8	18	
Frank Burtsfield	Tipp.	160	1	15	11	
Andrew Konya	Jasper					Up to 7 per day
Tom Hoover	Fulton	250	3	45	5	4-6 per $\frac{1}{2}$ day, best
Harry Decker	Winamac	640	5	75	8	
Dr. E.H.Powell	Porter north end	160	1/5	3	50	
Dr. E.H.Powell	Porter south end	200	5	75	3	
Elmer Jamison	Laporte	160	1/4	4	40	

has been more extreme and widespread in Illinois.

It is quite clear that no state presents a better opportunity for the large-scale enhancement of quail productivity through management.

No attempt will be made in this report to present all over again the basic appraisal of the quail situation brought out in previous reports. The following captions present only new material, or material peculiar to, or specifically for, Indiana.

History of Winter Losses. The attached table, based upon the recollections of the most careful observers I could find, corroborates the conclusions already reached for Illinois, namely:

- (1) Winter losses occur almost to the southern extremity of the 2 states.
- (2) The reason they occur so far south is that sleet storms increase as the probability of extreme cold or snow decreases southward.
- (3) There must be a difference between the weather resistance of the quail in central and southern Illinois, and those of southern Lake states.

Table E indicates that the incidence of killing winters is about 7 years, instead of 10 years as found in adjoining states. Both figures so far as the are concerned, are premised upon absence of winter feeding or other forms of management. It appears obvious that the interval between losses can be lengthened and the severity of losses decreased by skillful winter feeding and other management methods.

The widespread abundance of breeding quail observed personally throughout Indiana during the field work leads to the thought that winter feeding has now reached sufficient importance to actually be a factor in reducing winter losses. Of course, the extreme weather of 1928-29 diminished eastward until the opposite condition obtained on the Atlantic coast. No attempt was made to appraise just how,

TABLE E
WINTER QUAIL LOSSES - INDIANA

<u>Observer</u>	<u>Territory</u>	<u>Winter of</u>	<u>Remarks</u>
Geo. W. Miles	Whole State	1911-12	"Greatly decimated - in 1911 quail abounded, particularly in S. half - now scarce" P. 235 Report.
Dietrich	Clark Co.	About 1880 1917-18	Remembers this as a boy. Heavy loss-(don't remember 1911-12 loss)
D.A. Dunlevy	Clark Co.	1917-18	"Killed nearly all the quail here."
Homer Phillips	Jackson Co.	1917-18	Was last bad winter. Found 13 birds emaciated and frozen in a bunch.
" "	Bartholomew	1897-98	Snow for 6 weeks. Heavy loss.
John Vandewalle	Jackson Co.	1917-18 1896-97-	Only half a crop 1918. Found frozen birds. Loss even heavier than 1917-18. (Means 1897-98?)
Frank Gentry	Brown Co.	1924-5 1917-18	Loss from Feb. sleet. No heavy loss since. Statewide loss, worst ever known.
Arthur Murray	Sullivan Co.	1917-18	Only half a crop 1918.
M. L. Neeley	Grant	1924-5	Light loss. None since.
H. D. Fleming	N. Indiana	Between 1900 and 1905	Killed all the quail in N. Ind. Had to restock with Texas birds (Maybe 1897-8?)
George Hunt	Wayne Co.	About 1905	Only serious loss remembered previous to 1917-18.
Harry Wheeler	Kankakee Co. Ill.	1917-18 1890	Bad loss. About 40 years ago had a heavy loss on both quail and prairie chicken.

SUMMARY

1880-1			
1890-1	interval	10	years
1897-8	"	7	"
1904 -5	"	7	"
1911-12	"	7	"
1917-18	"	6	"
1924-25	"	7	"

Conclusion: Total - 7 losses in 49 years, or 1 each 7 years.

extreme the winter was in Indiana, but the survival of quail in southern Wisconsin indicates that winter may have affected their survival in Indiana.

Excess Cocks: The Sex Ratio Problem. In Indiana I encountered for the first time a widespread impression among sportsmen that there was an excess of cocks over hens. A summary of the estimates and counts made by the best observers I could find is presented in Table F. The estimates may be regarded as proving nothing except a probability of a disturbed sex ratio, but the three counts, even though based on a memory only, indicated quite strongly that there is either an exceptional tendency to kill cock birds in Indiana, or else that there is an actual preponderance of cocks much greater than that found by Stoddard in Georgia. Stoddard found that during the 1924-5 shooting season, on 9 Georgia preserves reporting a total of 2,871, the cock-hen ration was 54-46, while on 4 preserves reporting 2,899 quail during the season of 1925-8, the ratio was 52-48. Stoddard quotes Edward R. Coleman of Lebanon, Pa., as finding from 51 to 80% of cocks in various years in various states. All of these shooting records are open to the possible error of a difference in the case of killing the two sexes or a case of deliberate intent to kill males in preference to females. Stoddard's trapping records eliminate this source of error. Of 1,700 trapped during two springs in Georgia on two areas, the record shows from 1 to 3% more cocks than the shooting figures from the same areas. In other words, shooting according to Stoddard's preliminary findings, shows a greater percentage of cocks than actually exist on the ground.

It would be premature to speculate at this time about the cause of a disturbed sex ratio in Indiana; the first problem is to find out whether the disturbance exists. To this end a picked

TABLE F

SEX RATIO OF QUAIL IN HUNTING SEASON

Indiana

<u>Observer</u>	<u>County</u>	<u>Year</u>	<u>Estimate Cock: Hen</u>	<u>Count</u>	
				<u>No. Birds</u>	<u>Cock:Hen</u>
Gentry	Brown	Last 3	75 : 25 (Bases this on recollection of several thousand birds shot. Thinks it varies between years. Found 15 scratched nests 1 year).		
*Lyons	Monroe		(Noticed no preponderance).		
Crowmer	Owen	Average	66 : 33	(Has found scratched nests.)	
*Cude	Knox	Average	60 : 40	(Never saw a scratched nest)	
*Siegeman	Steuben	1925 or 6		32	94:6
	DeKalb	1926 (Never saw scratched nests)		20	50:20
Fleming	Allen	1923 ? 1928		400 ?	66:33 50:30
		(1923 count from kill of 12-15 hunters. Figures from memory)			
*Decker	Wells				(Noticed no preponderance)
Baker	Wayne				(Heard of excess cocks but doubts it)
*Cass	Kosciusko				(Noticed no preponderance)
Konya	Jasper	Average	60 : 40		
*Ruh & Hoover	Kosciusko	1926 ?		200	65:35
		(Figures from memory)			
Decker	Pulaski				(Has impression there are excess cocks)
Smith	Jasper	Average	(Sees more cocks than hens in training dogs)		

*Men selected to make sex ration count next fall.

group of 6 sportsmen, consisting mostly of technical men or men in professions accustomed to accuracy, have agreed to count their bags next fall. The resulting figures will be turned over to the Biological Survey and the universities holding quail fellowships for such further investigations as the showing merits.

Mr. Frank Gentry of Nashville is entirely convinced that a heavy excess of cocks exists, at least during some years, and states that last year he caught by hand 9 male birds during a 2 week's period while they were engaged in fights. He also states that he saw from 10 to 15 nests during the same year which were scratched up and destroyed by these excess fighting males, according to his belief. Many of these nests contained eggs, the remains of which lay around the scratched nests. If it be true that a bad excess exists then it is not impossible that there is an actual destruction of nests by fighting cocks, as believed by Mr. Gentry.

Phenology. The following fragments of phenological data may prove useful in the timing of research operations or later in management work.

Phenology of Quail
Indiana 1929

<u>Phenomenon</u>	<u>Date</u>	<u>Observer</u>	<u>County</u>	<u>Remarks</u>
Covies Still Intact	May 10	Ruh	Kosciusko	Saw covey of 12.
Covies Pairing	April 25 April 18	Crowmer Smith	Owen Jasper	
Whistling Began	May 10	Dunlevy	Clark	
Laying Began	May 15 May 13 May 20	Gentry Ruh Ruh	Brown Kosciusko "	11 eggs, May 26 7 eggs, May 20 1 egg, May 20
Clutches Full	May 27 May 1	Crowmer Wright	Owen Jasper	

Young Hatched.

Big Covies. Abnormally large covies, such as have been reported to occur in winter by Stoddard in Georgia, were reported by Indiana

sportsmen as follows.

<u>Observer</u>	<u>County</u>	<u>No. in Covey</u>	<u>Remarks</u>
Dunlevy	Clark	40	Nov. 15, Stayed together all winter. Had 20 left by spring.
Mathers	Monroe	20	Never larger.
Shaw	Monroe	40 Nov.	Large covies more common toward end of season
Fleming	Allen	50-80, Dec.	
Smith	Fulton	50 Nov.	

The fact that most of these exceptionally large covies are observed late in the season is an indication that they represent concentration on some particular food supply.

Length of Flight. In the Illinois report an instance was cited of quail falling into the Mississippi River at Alton, Illinois, after flying $\frac{1}{2}$ mile from a 200 foot initial elevation. These birds, however, may have been tired to begin with, since John Greyerson, who trains dogs in Jefferson County, reports seeing one particular covey fly at least one mile. This covey had some elevation to start with. The distance was obtained by having the birds flushed by a helper, Greyerson stationing himself at the point where they were accustomed to alight.

The possible length of flight bears on management in that it measures the possible isolation of quail on islands.

High and Low Years. No special effort was made to measure yearly fluctuations in abundance, but the following miscellaneous data may be of use to other observers wishing to establish facts on this subject.

<u>Observer</u>	<u>County</u>	<u>Year</u>	<u>High or Low</u>
Lyons	Monroe	1928	Low
Shaw	Monroe	1928	Low
Murray	Sullivan	1928	Average
Wright	Jasper	1928	Extra Good

Mathers noted a heavy proportion of squealers, or immature birds, during the 1928 season in Monroe County. This usually follows delayed broods due to a combination of rain and predators, and 1928 was, of course, a year of heavy rains.

Non-Breeding Coveys. The existence of non-breeding coveys of Hungarian partridges discussed elsewhere in this report makes it seem worthwhile to report a non-breeding covey of quail observed by Decker 5 miles north of Winamac, Pulaski County, in 1927. This covey remained intact throughout that year and was definitely observed to contain both sexes. This occurrence may have its analogy in the observed fact that gambel quail in Arizona remains in coveys during extra dry springs, but pair off and nest with the beginning of the summer rains. Apparently some environmental condition determines incidence of the breeding instinct.

Foods. No attempt was made to gather information on foods, but it is worth recording that many observers in Indiana on their own accord mentioned the importance of ragweed. Several also mentioned finding beechnuts in quail crops. There is said to have been no state-wide beech mast for 21 years in Indiana, although light local crops of beechnuts have occurred during that period. There was a local mast in Monroe County in 1928 and in Fulton County in both 1927 and 1928.

Exotic Quails in Indiana. The most important fact to be recorded is that the Indiana quail blood has not been diluted by the wholesale importation of Mexican stock to the same extent as is the case in Illinois. As pointed out in the Illinois report, Mexican stock is regarded

as undesirable, at least within the zone subject to winter killings, for the reason that plantings of such stock cannot possibly do any good except on areas wholly depleted of seed birds, and many possibly do a great deal of harm in lowering the resistance and changing the habits of native birds.

No special effort was made to locate the plantings of Mexican stock which have occurred, but the following instances were encountered, and are set down for what lesson they may contain:

- (1) 200 pairs of Texas (probably Mexican) quail were put down last year by the Izaak Walton League near Terre Haute. The local impression is that they are all gone.
- (2) A plant made about 1916 southeast of Henryville in Clark County. Result not known.
- (3) A plant made shortly after 1900 in Allen County after the alleged complete loss of native birds through a hard winter. Some sportsmen in Fort Wayne have concluded that all of the present thriving stock of quail in that region is derived from this Mexican plant, but this conclusion may be considered as doubtful. If there were such a thing as a winter capable of completely annihilating quail over large areas, there could not be the quick comeback after hard winters which actually takes place in almost every instance even without artificial replacement of seed stock.

In addition to the sporadic plantings of Mexican Bob-white above noted, there was a covey of quail with topknots (probably scaled quail or California valley quail), between Spencer and Whitehall in Owen County in 1927 and 1928. These are said to have remained in an intact covey without pairing off or nesting, and are now shot out. Who planted them or where was not determined.

Quail Clubs and Preserves. Indiana has as yet developed only a few of the most rudimentary beginnings toward the deliberate management of quail on privately controlled areas. The following clubs and preserves were encountered:

1. A new club on the Bean Blossom bottoms northeast of Dolan in Monroe County, consisting of Indianapolis people and officers of the Showers Furniture Co. None of the members were seen, but I was told that no special efforts at management had as yet been started.
2. A new club near Travalac in Brown Co. on the bottoms of the Bean Blossom River. I did not see any member of this club, but was told that no cultural or management measures had been inaugurated.
3. The Powell-Cresley game preserve, recently purchased by Powell-Crosley of Cincinnati, and located south of Vernon in Jennings County. Area, 1,000 acres. Started 1928. Game management on this area is in charge of Alfred L. Harder. Winter feeding is practiced, but no other management measures are as yet under way. The reports of the Georgia quail investigation are being sent Mr. Harder.
4. C. E. Pierson of Terre Haute has leased a tract east of Carlisle. Mr. Pierson was out so I could not see him about management, on this area.

Field Trial Grounds. The 4 field trial areas shown on the map ought to constitute important demonstrations of quail managements. None of the officials were seen except Harry Decker of Winamac, president of the Rennsalaer Field Trials, who was very much interested in getting Stoddard to look over the ground and advise as to building up the quail crop.

The field trial grounds in Gibson are operated by the Southern Ohio Field Association.

The grounds in Jefferson are also used by the Southern Ohio Association, but only part of the time.

Lafayette and Fort Wayne Quail Projects. The Izaak Walton League of Lafayette, under the leadership of Fred C. Dobelbower, several years ago inaugurated a project to make a careful census of quail on a representative group of farms throughout a series of years, a part of the farms to be moderately shot, and the rest unshot, with a view to demonstrating whether moderate shooting reduced the quail crop where a suitable environment was provided. The preliminary census was actually made for 1 year, but the project has since lapsed for lack of man-power to execute the field work. The idea behind it was substantially identical with the idea behind the Institute Quail Fellowships, except that it did not include the deliberate manipulation of experiment by a scientific institution in order to gain more skillful work and wider credence for the results.

Mr. Dobelbower immediately appreciated that an Institute Fellowship operated through the Agricultural College at Purdue, with the sportsmen cooperating as interested observers, constituted a practicable means of reviving and extending the original project. ~~XXXXXXXXXXXXXXXXXXXX~~ He was to send me the documents and records of the original project to be summarized in this report, but they have not arrived.

The Fort Wayne chapter of the Izaak Walton League has in mind the acquisition and operation of a game preserve. I pointed out to Mr. H. N. Hilgeman that Allen County is not pheasant country, and that quail are susceptible of management by the preserve or refuge method, and I suggested that a demonstration of quail management on going

private farms would have a larger public value than a publicly owned preserve. While such suggestions are made in many places, this particular one seems worth setting down because the record of the Fort Wayne chapter for actually executing its projects makes it seem possible that some valuable move will actually be inaugurated here.

The Covert Factor. Any attempt to appraise the factors of productivity for Indiana quail must, I think, rest upon the premise that coverts are the limiting factor over most of the state except possibly within the rough wooded area hatched in purple on the accompanying quail map. While there are enough or even too many coverts (in the quantitative sense) within the purple area, much remains to be done to improve the kind and distribution of coverts.

Broadly speaking, the whole state is deficient in coniferous trees, grapevine tangles, or other coverts suitable for winter use.

There is one winter covert not found in the adjacent states, and that is the wild rose tangles occurring in certain counties of the Till Plain. This is not the ordinary wild rose but the prairie rose, which has more vigorous, stiffer, thornier growth.

The whole state, and especially the richer part of the Till Plains, is deficient in the dispersion of coverts. Brush fencerows and pastures dotted with cl^ups of red haw and wild rose furnish some dispersion, but the brushy gullies characteristic of southern Illinois are largely lacking. Gullies are of course seldom found in glaciated country, but even the unglaciated type, it seems to me, has less vegetation in the frequent gullies than in the equivalent parts of Illinois.

This is of course a disadvantage not only to quail conservation, but the still more important question of soil conservation.

I heard of one 160 farm known as the Harris farm(owned by Otto McMann), and located near Rochester in Fulton Co., which was heretofore exceptionally favorable for quail in the dispersion of fencerow coverts, but which was completely de-brushed last winter. This farm is said to have had at least 4 covies in 1928. Mr. Fred Ruh of Rochester has agreed to make a careful census at the opening and close of the 1929 season in order to determine the effects of the removal of brush on the quail population. The area is of course too small to be ideal for measuring this variable, and the effect may be expected to be greater by the spring of 1930 than the fall of 1929.

Mr. Frank N. Wallace, state entomologist of Indiana, surprised me by giving it as his opinion that fencerow coverts are probably beneficial rather than detrimental from the viewpoint of controlling injurious insects on Indiana farms. He thinks that the birds which find harborage in such fencerow coverts control the insect risk to at least the same extent as would be the case if the coverts were removed and there were no harborage for either birds or insects. Of course any such generalization cannot be expected to hold absolutely for each possible local combination of conditions, but the existence of such open-mindedness on the part of an agricultural authority seems worth recording.

If it be true that coverts are, broadly speaking, the limiting factor on Indiana quail, by what mechanism are such coverts to be extended and improved? In my opinion the answer is the same as that developed in detail in the preceding reports, namely: by compensating

the farmer for the privilege of harvesting the game crop and thus giving him an incentive for improving and extending coverts and for other management measures. If the individual farmer happens to be interested in harvesting his own crop, or if he happens to be interested in more quail for other reasons than shooting, then the enhanced crop is of itself the necessary incentive.

Proposed Closed Season; Farm Sentiment. While no attempt was made to analyze in detail the legislative situation, it was clear from the conversation of sportsmen, farmers, and naturalists throughout the state that a powerful agitation exists for placing quail on the songbird list. Bills to accomplish this result are introduced into each succeeding legislature, and the Farm Bureau Federation takes a leading part in urging their enactment into law.

I called upon Mr. W. H. Settle, president of The Farm Bureau Federation, but there was no opportunity to discuss this particular question in detail.

One fact stands out clearly from the mass of conflicting opinions on this subject: it was only the relative abundance of quail which prevented their being placed on the songbird list during the last legislative session. It seems perfectly clear that an abundant quail crop is by far the most effective assurance against the repetition of Ohio's experience in Indiana. While there is a very satisfactory stock of birds this spring even after the hard winter of 1928-29, the indefinite continuance of an abundant crop can hardly be expected as long as that crop remains, as at present, largely a matter of accident. The threat of closure should constitute an especially urgent reason for the prompt inauguration of management research and the actual practice of management.

on clubs, preserves, field trial grounds, the properties of farmer-sportsmen, and other available demonstration areas throughout the state. To speak bluntly, the next few years will see a race between the quail management and quail closure. The only possible way for management to win is to prove that it can produce an abundance of quail, and hence that closure is unnecessary from the viewpoint of conservation.

The farm sentiment toward quail is especially favorable. Many farmers are said to post against quail hunting, but to allow free hunting of rabbits, pheasants, and even Hungarians on the same ground. Of the various game birds, it is clear that pheasants are in the least favor, Hungarians are intermediate, whereas quail are almost universally valued and desired by farmers.

I met one farmer in Newton County who was personally convinced that quail were a necessary preventative for the Hessian fly which is very destructive of wheat. In the light of such cases, the frequent attempts of sportsmen to prove that quail are not an insectivorous bird seem especially ill-advised and futile, especially since the only evidence available to sportsmen is usually the content of the crop during the shooting season, and this is far from conclusive evidence of what the quail eats during the remainder of the year. The frequency with which sportsmen attempt to prove that quail are non-insectivorous is the most striking evidence I know of that the sportsman's movement needs a radical re-orientation along more constructive lines of thought.

Summary of the Quail Situation in Indiana.

1. The future of quail depends on the solution of the farm trespass problem.

If no solution is found, farmers will eventually close up quail to get rid of hunters. There will then be no incentive to improve environments, and quail will shrink in the south for lack of feed and in the north for lack of coverts. There will always be quail, but their abundance will be accidental, varying widely between regions and between years.

If a solution is found (such as making quail an income-producing farm crop) quail will expand in distribution and abundance, with more uniformity between years and regions than is now the case. The food and coverts provided for quail will greatly benefit other beneficial wild life. The only substantial difference to the average hunter will be that he will pay to some nearby farmer in shooting fees the money he now burns up in car mileage in the search for free shooting. Both the farmer and hunter will, in self-interest, have to learn the rudiments of applied biology. The educational value of this is often overlooked. It is possibly as great as the value of the hunting itself.

2. There is little evidence that this or any other constructive solution of the farm-tresspass problem is in process of being developed. The first stage of change, namely widespread posting of farm lands, is nearly complete, but this is merely negative. It merely means that the old system of free utilization of accidental game crops is no longer acceptable to the owner of the land on which the crop grows.

The number of quail clubs or preserves or toll farms is still very small, and their efforts at management very feeble. So far they are, so to speak, merely excluders of the public rather than producers of game. If it be true, as I believe, that farmer-initiative in quail production is the only alternative to a statewide

closed season, then it is of critical importance that successful demonstrations of what it can do be set up at the earliest possible moment.

3. The degree of success achieved by such demonstrations will depend upon the stock of dependable biological facts developed through research, and the skill developed in applying such facts to the demonstration areas. Of this, more will be said under the sections of the report dealing with research and with state and private leadership.

4. Even if successful demonstrations of quail management are forthcoming, management will not necessarily be practiced by farmers throughout the state unless there is a profitable market for the crop. There can be no market as long as sportsmen continue to hold their present nearly universal prejudice against compensating farmers for the shooting privilege. It may be asking too much to expect sportsmen's organizations to suddenly reverse themselves and advocate paid shooting, but it would not be too much to ask that they approach the question with an open mind, and signify their willingness to pay for shooting if and when it is produced at a price within reach of the average citizen. Of this, more will be said under the section on the conservation movement in Indiana.

9. Hungarian Partridge.

History of Plants. Indiana is the only state so far encountered which had a complete record of the time, place, and number of birds planted during past years. There was no record of the success of these plants, but this information was gathered in the course of my field work and the whole combined in Map G. (A larger and more accurate map containing the original field data is in the files of the Game Survey.)

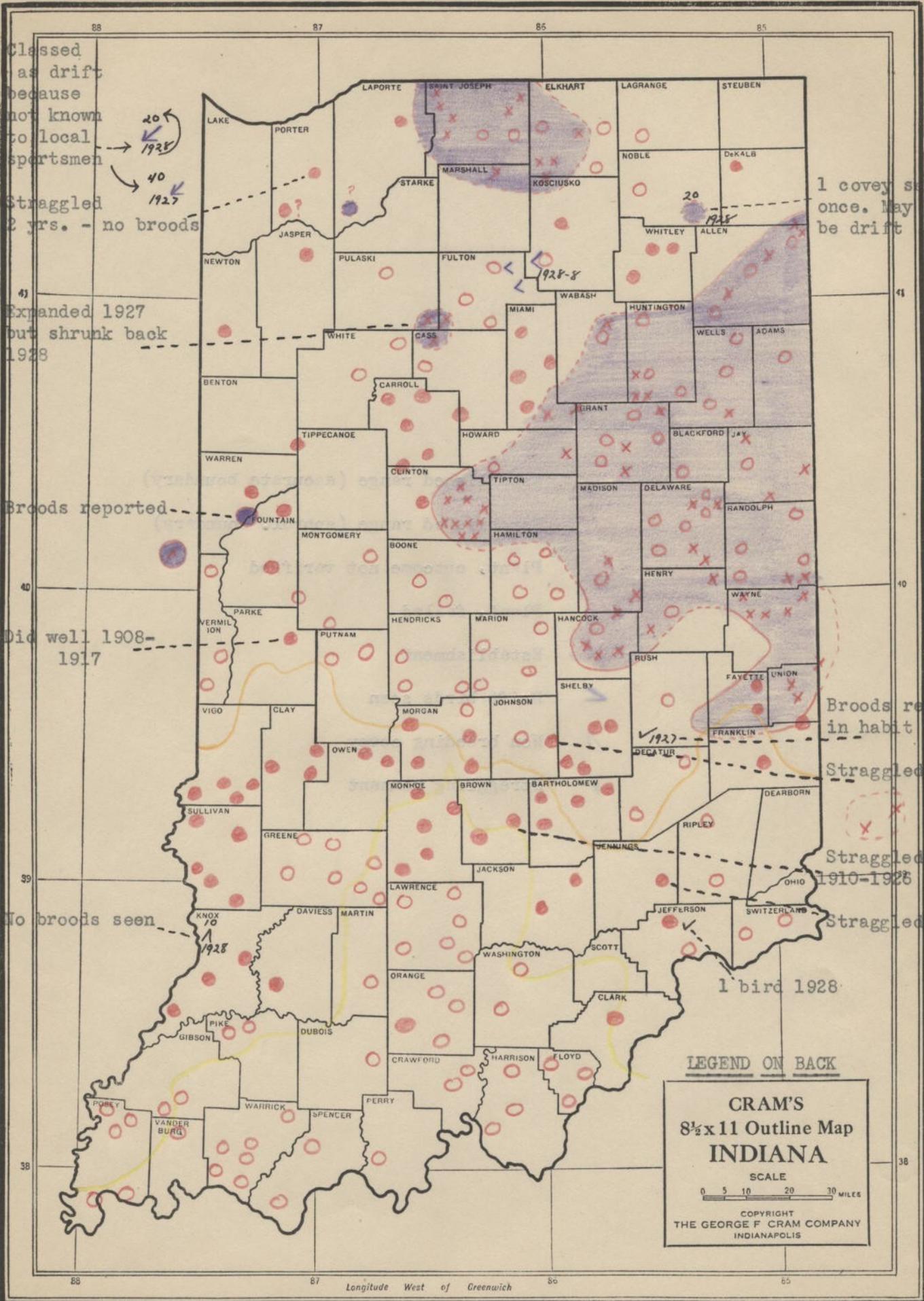
Practically all of the plants shown by small circles on Map G were made in 1908-9, and 10; hence the dates are omitted on the map. The great majority of plants were repeated for two and sometimes three successive years during this period. The number of birds per plant (that is, the number actually put down for each of the circles shown on the map) varies from 25 to 200, and in exceptional cases runs as high as 500 birds. All of these plants were made on "game preserves", which consisted of a group of farms leased by the state for a nominal consideration on condition that the owners prohibit shooting.

The reason for this heavy concentration of plantings during the 3-year period 1908-10 was that a law was passed in 1907 which established a resident hunting license and required that one third of the receipts be spent on plantings of game birds. Commissioner G. W. Miles in his 1913 report says:

"It now appears that the provision in the law - - was an unwise one. - - a smaller investment would have been sufficient to test - - European birds in Indiana. - - \$60,000 was expended - - Reports from 300 game preserves 2 years ago led me to believe that we were to succeed with Hungarians - - as they seemed to be raising broods - - To these were added 3,000 pairs imported from Europe. Since then the numbers - - have not increased but have grown less, and indications are they will shortly disappear altogether."

A total sum not far from \$100,000 was evidently spent on Hungarian plants. The existence of a record, plus the fact that the plants were

Map G: Hungarian Partridge



Classed as drift because not known to local sportsmen

Straggled 2 yrs. - no broods

Expanded 1927 but shrunk back 1928

Broods reported

Did well 1908-1917

No broods seen

1 covey seen once. May be drift

Broods reported in habit brush

Straggled 1910-1926

Straggled 1910-1925

Straggled 1910-1916

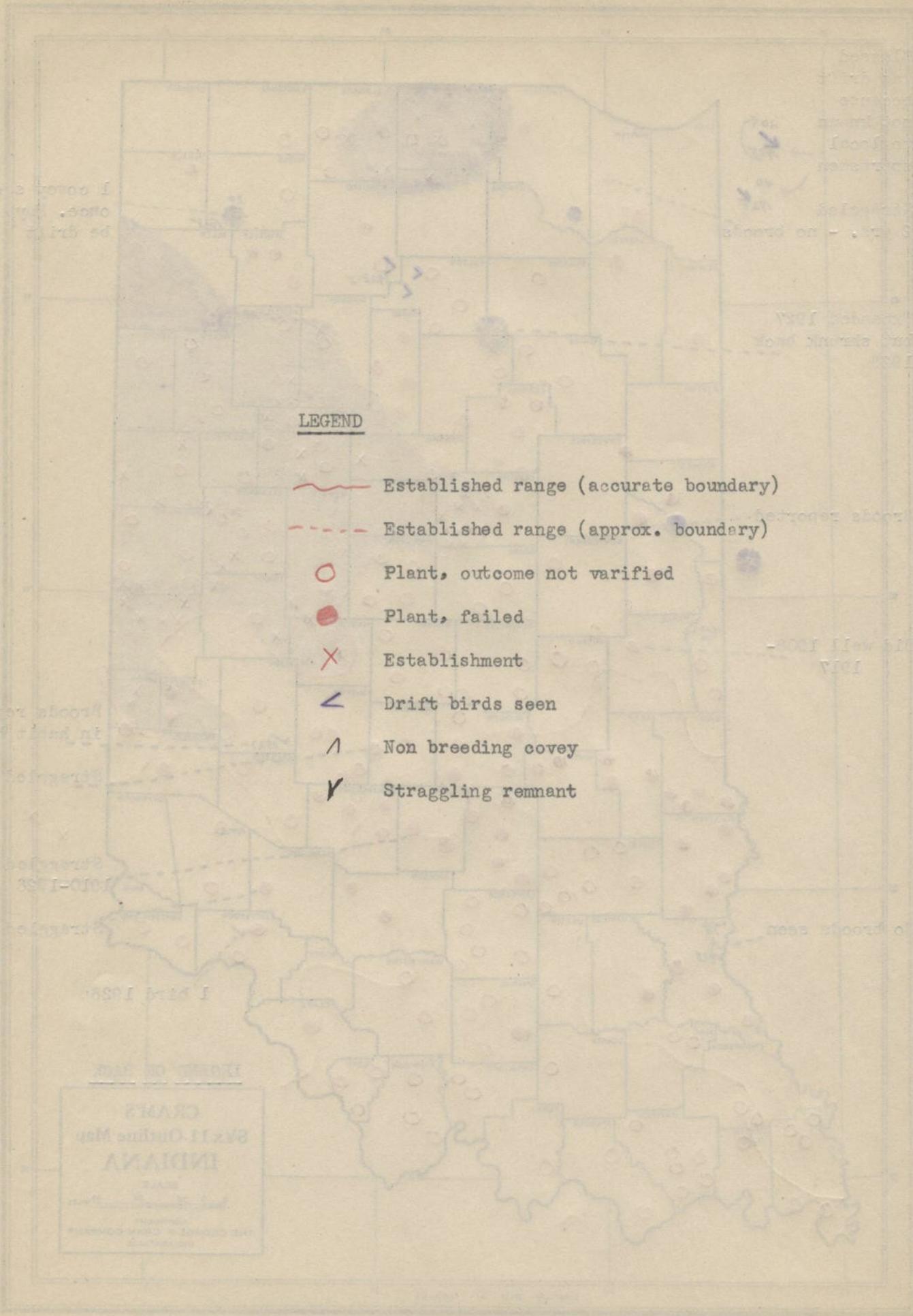
1 bird 1928

LEGEND ON BACK

CRAM'S
8 1/2 x 11 Outline Map
INDIANA

SCALE
 0 5 10 20 30 MILES

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 INDIANAPOLIS



LEGEND

-  Established range (accurate boundary)
-  Established range (approx. boundary)
-  Plant, outcome not varified
-  Plant, failed
-  Establishment
-  Drift birds seen
-  Non breeding covey
-  Stragglng remmant

INDIANA
 82x11 Outline Map
 CRANE
 THE BUREAU OF BIRDS AND MAMMALS
 U.S. DEPARTMENT OF AGRICULTURE
 WASHINGTON, D. C.

repeated through a series of years, plus the fact that they were practically statewide in distribution, all combine to make Indiana an exceptionally favorable state in which to draw conclusion from past history on the important question of what constitutes Hungarian range.

Because of this exceptional opportunity a special effort was made to map the survival of the birds. The result appears on Map G.

Results of Plants. It is evident from Map G that survival is confined to one cleanly blocked area in the east central portion of the state and another smaller but equally cleanly blocked area in the north central portion and extending into Michigan. This extension may force a revision of the conclusion expressed in earlier reports that the Michigan Hungarians came from Ohio.

Outside of these areas of survival, Map G shows a gradual transition from immediate disappearance of plants in the south part of the state to straggling survivals which increase northward as one approaches the established range. There are breeding coveys still surviving in Fountain, Pulaski, and Cass Counties. The first is clearly a remnant of the original plant, the latter may be a recent drift. In addition there are records of drift birds during recent years in Fulton, Kosciusko, and Noble counties.

The significance of these survivals will be brought out in a later caption. We have first to define the abundance and behavior of the birds on their established range.

Census Data. Table N gives the census figures gathered in Indiana with representative English figures for comparison. With due consideration for the size of the areas in each case, it may be concluded that Hungarians in their Indiana range have attained an abundance fully as great as they would attain without management in England, and conversely that management in Indiana can probably produce partridge shooting equal to that of England."

Census-taking on Hungarians is much more difficult than quail because of the evident mobility of the species. Like the pheasant, the Hungarian has a comparatively long annual cruising radius. This naturally results in temporary concentrations on hogged corn or other favorite foods. Table H gives a few figures on such concentrations:

TABLE H

Observer Locality County	Acreage	Year	Covies	No. Birds Per Covey	Birds	(Bird Acres PER B
Frank W. Wallace	160	1910	2	30	60	2.7
Jas. B. Powers Farm (about)		1914			2	80.0
S. E. Greenfield		1926	1	30	30	5.3
Hancock Co.		1928	2	30	60	2.7
(These birds planted in 1909. Loss in 1914 laid to heavy snow 1913)						
S. B. Sims	160 ?	1928	1	22	22	7.0
Farm Kerklin, Clinton Co.						
R. H. Daugherty	7,000	1928	20	25?	500	14.0
N.E. Corner of Clinton Co.	(Been in this section since planted in 1910)					
M. L. Neeley	80	1927	?	?	200	0.8
3 mi. E. Mont- pelier, Blackford Co.	(plus 80 adjoining)	(These birds ate up a tomato crop on this farm)				
M. L. Neeley	200	1927	1	25?	25?	8.0
J. P. Doty Farm W. Marion Co.	(Also 3 covies quail on this farm)					
Jno. Decker	160?	1928	3	20 to 50	100	1.6
Sam Garrett Farm Wells Co., 8 Mi. S. Bluffton	(Another nearby farm had only 5 non-breeding birds)					
AYMER MAXWELL:	best years, best beats, under best management, about					0.5
ENGLAND	average year, 6,000 acre tracts, good " , "					2.0
RICHARD PAGE	400 acre farm, ordinary management, about.....					1.3
ENGLAND						

TABLE H,

Temporary Concentrations of Hungarian Partridge in Indiana

<u>Observer</u> <u>County</u>	<u>Month</u> <u>Year</u>	<u>Area</u>	<u>Flushed</u>	<u>Acres Per Bird</u>
Bowman Wells Co.	Fall 1927	25 acres of bogged corn	5 covies 10-20 each, or 75 birds	0.3
J. J. Charles Huntington Co.	?	19 (?) acres of stump land	3 covies of 20(?) each, or 60	0.2
John Goodrich Randolph Co.	Nov. 1928 ?	40 acres ? corn	100	0.4

Abundance Relative to Other Species and States.

<u>Observer</u>	<u>Comparing</u>	<u>With</u>	<u>Says</u>
Fleming	Hung, in Wells, Blackford, & Jay Cos., Ind.	Hungs. in Ohio	Much thicker in Ind.
Decker	Huns. in Wells Co.	Quail in Wells Co.	Not quite as many Huns. as quail.
Bowman	Huns, in 1927, Wells Co.	Quail in 1927 Wells Co.	More Huns. than quail in 1927
Arnold	Huns, in Randolph Co.	Quail in Randolph Co.	Not quite as many Huns. as quail
Coffel	Huns. in Jay Co.	Quail in Jay Co.	Only 1/3 as many Huns. as quail.
Baker	Huns. in Wayne Co.	Pheasants in Wayne Co.	3 times as many Huns.
Baker	Huns. in Wayne Co.	Quail in Wayne Co.	Many times more quail than Huns.

Is the Hungarian a Cyclic Species? In the Illinois report it was observed that an extraordinary spread into new range had occurred in the Chicago area (and in Wisconsin) in 1925-26. It was suggested that possibly this had some connection with the grouse cycle, which reached its peak in various states at about that time.

Chart J presents the combined data on high and low years for Hungarians in Indiana and Illinois since they were planted in 1908-10, and gives also (in orange) the Michigan grouse cycle insofar as known for the same period.

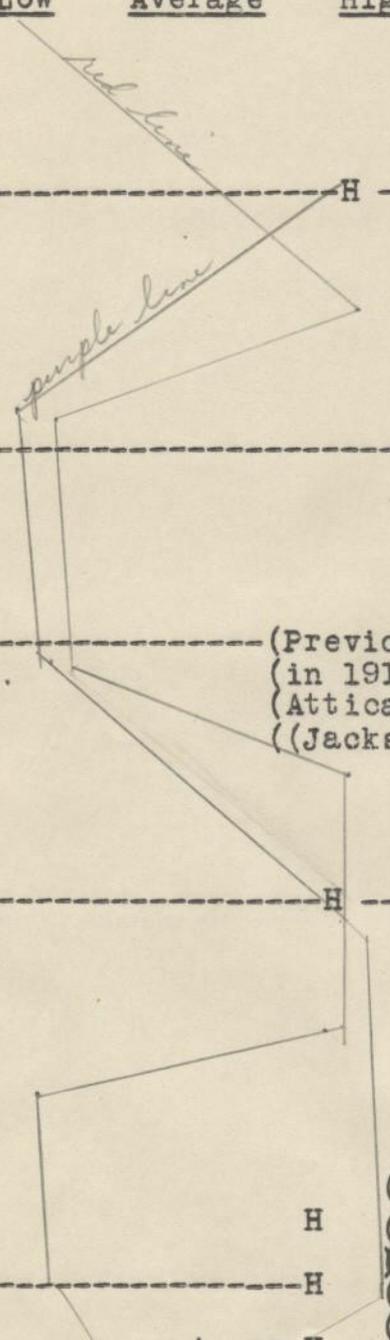
Not even tentative conclusions should be drawn from this chart without emphasizing the fact that the data on Hungarians are very meagre back of 1925. That there was a period of abundance and geographic aggression from 1925 to 1927 in both states is no longer open to doubt. It also seems fairly clear that 1928 was not as good as 1927 in either state.

CHART J

Game Survey Aldo Leopold June 15, 1929

High and Low Years - Hungarian Partridge - Illinois and Indiana - 1908-28

<u>Year</u>	<u>Low</u>	<u>Average</u>	<u>High</u>	<u>Observer</u>	<u>County</u>	<u>Evidence or Remarks</u>
1908						<p>(Supporting Evidence: 1908-9 plants increased to full stocking on Jas. B. Powers Farm (see Census), falling off again around 1914.</p>
1909						
1910			H	Wallace	Hancock (Ind)	
1911						<p>(Contrary Evidence: Many plants disappeared on ground since proved unsuitable.</p>
1912						
1913						<p>(Nearly disappeared from Powers Farm about 1914. (See census) (Date uncertain.)</p>
1914				Wallace	Hancock	
1915						
1916						<p>(Previously thriving plants disappeared in 1917 at Vernon (Jennings Co.) and Attica (Fountain Co.). Plant at Seymour ((Jackson Co.) disappeared between 1915 and 20.</p>
1917						
1918						
1919						<p>(St. Joseph Co. birds spread 15 mi. SE to Nappanee region and have been thriving there ever since.</p>
1920						
1921			H	Parks	Elkhart	
1922						<p>(Supporting Evidence: (a) Abundance: Bowman (Wells Co.) and Goodrich (Randolph Co.) say 1927 was the banner year. Wallace (Hancock Co.) says birds back to full abundance on Powers Farm. (b) Spread: Decker (Pulaski Co.) says Cass 12 mi. NW to Starr City; withdrawn again by 1928. Hunt says first birds appeared in NE Union Co. 1928. (c) Drift: Drift covies seen by Korsgard in Will Co., (Ill.) 15 and 30 mi. SE of home range near Wheaton, 1927. Parks (Noble Co.) saw drift covey at Wolf Lake 25 mi. N. of Huntington Co. range, in 1928. Drift birds seen at Rochester (1927?), Manitou Lake (1928), Mentone (1927 or 8). Contrary Evidence: Birds at Moscow (Rush Co.) disappeared 1928 and at Spencer (Owen Co.) 1926.</p>
1923						
1924						
1925						<p>(Supporting Evidence: (a) Abundance: Bowman (Wells Co.) and Goodrich (Randolph Co.) say 1927 was the banner year. Wallace (Hancock Co.) says birds back to full abundance on Powers Farm. (b) Spread: Decker (Pulaski Co.) says Cass 12 mi. NW to Starr City; withdrawn again by 1928. Hunt says first birds appeared in NE Union Co. 1928. (c) Drift: Drift covies seen by Korsgard in Will Co., (Ill.) 15 and 30 mi. SE of home range near Wheaton, 1927. Parks (Noble Co.) saw drift covey at Wolf Lake 25 mi. N. of Huntington Co. range, in 1928. Drift birds seen at Rochester (1927?), Manitou Lake (1928), Mentone (1927 or 8). Contrary Evidence: Birds at Moscow (Rush Co.) disappeared 1928 and at Spencer (Owen Co.) 1926.</p>
1926			H			
1927			H			
1928		A or H				<p>(Supporting Evidence: (a) Abundance: Bowman (Wells Co.) and Goodrich (Randolph Co.) say 1927 was the banner year. Wallace (Hancock Co.) says birds back to full abundance on Powers Farm. (b) Spread: Decker (Pulaski Co.) says Cass 12 mi. NW to Starr City; withdrawn again by 1928. Hunt says first birds appeared in NE Union Co. 1928. (c) Drift: Drift covies seen by Korsgard in Will Co., (Ill.) 15 and 30 mi. SE of home range near Wheaton, 1927. Parks (Noble Co.) saw drift covey at Wolf Lake 25 mi. N. of Huntington Co. range, in 1928. Drift birds seen at Rochester (1927?), Manitou Lake (1928), Mentone (1927 or 8). Contrary Evidence: Birds at Moscow (Rush Co.) disappeared 1928 and at Spencer (Owen Co.) 1926.</p>
1929						



It may be said that the well known continental depression in grouse culminating about 1927 appears to have a counterpart in Indiana Hungarians, but the Indiana data are too meagre to constitute anything more than a lead for future study under the Institute fellowship.

It may also be said that if grouse and Hungarians are effected by the same cycle, the present depression in grouse did not effect Hungarians till 1928, and then only slightly if at all. If Hungarians thrive in 1929 it should be cause for dropping the thought that they are subject to the grouse cycle, since grouse are already started toward a peak in the adjoining states.

Management Risk Compared With Quail. Quite apart from the question of a cycle, it may now be asserted with some confidence that Hungarians in the north central states experience greater fluctuations between years than do quail in the same region, and to this extent are a less desirable risk for investments of time or funds in game management operations. This, of course, is their history in Europe.

How New Range Is Added. Good years are characterized not only by greater abundance within their established range, but by the appearance of drifting covies on adjoining range. These drifting covies may take hold and breed, in which event we have a spread or geographic aggression, or they may shrink back or disappear, either at once or during the next poor year.

It seems as if large aggressions occur by drifting covies in fall rather than by mated pairs in spring. In no case so far observed has aggression occurred annually by small jumps. It occurs periodically by large jumps running as high as 15 miles in a year.

Possible Causes of Fluctuation. Before any hypothesis of cyclic fluctuation can be entertained seriously, high and low years should be examined in relation to weather. Weather is the accepted explanation of high and low years in Hungarians in England, and appears to account for our own less severe fluctuations in quail. Even in the case of the grouse cycle there is formidable evidence that weather affects the prevalence of the diseases or parasites which presumably are the direct cause of fluctuation.

It is also highly important to examine high and low years in relation to sex ratio. Much of the evidence in the case of the grouse cycle indicates excess males during depressions. This has been laid to hen mortality during incubation, but this is only one of several possible causes. Diseases may have a differential sex mortality.

All of these possible causes are appropriate for investigation through fellowships, rather than through the superficial methods necessary under the Game Survey. Successful game management demands that such basic questions as the cause of fluctuations in game populations be unraveled at the earliest possible moment; in fact, management is nothing more or less than the deliberate control of population curves.

What is Hungarian Range? The non-existence of a statewide soil map of Indiana made the correlation of survival with soil rather difficult. The proven range looks exactly like the till plains of Ohio, where Hungarians have failed. It is flat or rolling rich farming country with few woodlots, hardly any dissection, fairly large fields, and fairly heavy dark soil. Fencerow coverts or weedy fields are scarce. There are few or no swamps. The corn is partly shocked and,

partly left standing in winter. Ditchbanks seemed to constitute about the only year long cover, and are much used especially in winter. This may arise from the birds great aversion for wind, which is emphasized by Page (see Bibliography).

I am by now satisfied that there is no easily visible or obvious criterion of what constitutes good range. The following analysis attempts to sift the evidence in the states so far surveyed:

ANALYSIS OF CHARACTERS COMMON TO HUNGARIAN RANGES
in Michigan, Ohio, Indiana, Illinois, Iowa
Minnesota, Wisconsin

- A. Common Characters. The successful range so far examined is
1. All geologically of the newest (Wisconsin) glacial drift soil.
 2. All flat or very gently rolling topography with little or no dissection.
 3. All fertile farming soil, heavy to moderately heavy, but never light.
- B. Characters Holding in Some Regions, but absent in others (now dropped as essential criteria of good range).
4. Pot-hole or hummock swamps. Used in the Chicago and Wisconsin areas but absent in Indiana, Michigan, and Ohio.
 5. Original Prairie. Used in parts of the Ohio, Iowa, and Minnesota range, but absent in most of the Indiana, Michigan, and Illinois range.
 6. Black Soil. Used in Minnesota, Iowa and Illinois but absent in Ohio, Michigan, and most of Indiana range.
 7. Lake-Bottom Soil. Used in Ohio and Michigan, but not elsewhere.
- C. Conclusion. While characters 1, 2 & 3 hold on all the successful range, there are large regions possessing them on

which Hungarians have failed, viz: Central Ohio, N. Central Illinois, parts of N.E. Indiana, North Iowa. Therefore 1,2 & 3 are not in themselves sufficient criteria of good range. A search must be made for deeper and less obvious characters, associated with 1, 2, & 3 on the areas which have proven successful.

Such characters might be found in the:

8. Chemical composition of the soil (such as lime). Possibly affected by the underlying rock as well as the nature of superimposed glacial drift.
9. Some plant or insect containing some necessary vitamin or other chemical substance.
10. Physical nature of the soil, grit, cover, or feed.
11. Some disease or parasite absent from or scarce on the proven areas, or lacking the necessary intermediate host within them.
12. Some predator absent from or scarce on the proven areas (improbable).

D. Comment. The survival of isolated covies, mostly non-breeders, at considerable distances from the proven range indicates against 12, and suggests that the hidden factor pertains to breeding, or has its incidence during the breeding season. This might indicate 8, 9 or 11.

The sharp and relatively stable boundary of the proven range indicates against 12.

The alleged successful nesting but later disappearance of many of the original plants would indicate that the hidden factor operates on the young. This might be 9 or 11.

The intermittent aggression upon new range and fluctuating abundance on the old range indicates that the hidden factor fluctu-

ates between years, which would point to ll or some fortuitous combination of ll with other factors. It indicates a possible identity between causes of fluctuation and criteria of good range.

Food. Indiana was the first state so far encountered where there were any complaints of damage by Hungarians to crops. In northeast Clinton County farmers complained of damage to corn, but I was unable to find out whether by pulling the young corn or by shattering mature corn. Since the complaint occurred in spring it was presumably the former. Three miles east on Montpelier in Blackford County they are said to have eaten up a tomato crop during the fall of 1927, 200 birds concentrating on 80 acres. Pulling corn is alleged against Hungarians near Bluffton in Wells County.

These isolated allegations of damage are, of course, no evidence that the bird is injurious to agriculture. In the first place, such complaints need to be verified before acceptance, and secondly, almost any bird, no matter how beneficial, occasionally does damage under exceptional circumstances.

Relation to Brush. On typical Hungarian range in Clinton County, R. H. Daugherty, in commenting on the habits of these birds, volunteered the statement, "they cannot be driven into brush." In other words, within their established range these birds do not ordinarily seek brush, even when flushed and hunted. As against this normal behavior it is interesting to note that several observers, commenting on failed plants which had straggled for a few years, volunteered the observation that the Hungarians inhabited the same kind of brush as the native pheasant or ruffed grouse. As will be noted later, the same kind of behavior was observed in pheasants, that is, taking refuge in brush where planted in unsuitable country. In the Illinois report there is one instance of a frozen covey found

in a brushy woods, and in Wisconsin I have heard of one instance of apparently normal, healthy birds resorting to dense brush on a moraine near Racine. These facts are recorded for future reference, rather than for drawing conclusions at the present time.

Phenology. Future field studies (as well as future management) can be better planned if the normal dates of the principal life-history phenomena are known. The Table K, on the next page, gives fragments of phenology picked up in Indiana and Illinois, with certain English dates for comparison.

Bibliography. A digest of "New Ways With Partridges" by Richard Page appears in the Appendix.

*PHENOLOGY OF HUNGARIAN PARTRIDGE

TABLE K

Illinois & Indiana, 1929

<u>Phenomenon</u>	<u>Date</u>	<u>Observer</u>	<u>County</u>	<u>Remarks</u>
Covies Still Intact	March March	Hunt Wilson	Wayne McHenry Ill.	Pair in late March. "Soon as snow disappeared."
Covies Pairing	February	Auter	Fountain	
	April	Daugherty	Clinton	Quail pair in May
	Late March	Charles	Huntington	Huntington quail not till May
	Late March	Hunt	Wayne	
	<u>January 12</u>	<u>PAGE</u>	<u>ENGLAND</u>	(pp.27)
Laying Began	June 10	Neeley	Grant	This is date of first hay crop; destroys many nests.
	May 10	Bowman	Wells	
	April 19	Brewer	Lake(Ill.)	4 eggs April 23
	<u>May 9</u>	<u>PAGE</u>	<u>ENGLAND</u>	(pp. 77)
Clutches Full	June 20 May 25	Daugherty Bowman	Clinton Wells	19 eggs, in timothy
	<u>APRIL</u>	<u>MAXWELL</u>	<u>ENGLAND</u>	
Young Hatched	July?	Charles	Huntington	Found while cutting oats.
	May 15	Bowman	Wells	
	May 10	Goodrich	Randolph	First out.
	Late June	Hunt	Wayne	At haying time.
	<u>JUNE 15-28</u>	<u>PAGE</u>	<u>ENGLAND</u>	(pp.27)
Winter Packs		Neeley	Grant	Do not pack. Winter flocks 15-20
	In winter (date 7)	Auter	Fountain	Up to 100 birds.

*Entries in capitals are for comparison and are taken from Aymer Maxwell's "Partridges and Partridge Manors," Adam & Chas. Black, London, 1911; also Richard Page's "New Ways with Partridges," Field Press, London, 1924 (see Digest).

10. Ringneck Pheasant.

Indiana is a particularly difficult state in which to glean new facts about pheasants for the reason that the state plantings, while they began at the same time as Hungarians (1907-10) were very light, and it is impossible to tell whether the poor results are due to deficient plants or deficiencies of the country. No new or heavy plantings have been made until the last two years. These new plants are not old enough to have any results, but still new and frequent enough to obscure in many cases the results of the original plants.

History of Plants. Map L shows the plantings made by the state in 1907-10, plus a few scattering private plants made long enough ago to be significant. All very recent plants are excluded from the map.

The 1907-10 state plants were all in the form of birds rather than eggs. The number of birds and date appears on the map wherever the record was clear. It was evidently the impression in those days that the pheasant was a brush bird, since most of the stock was put down in the south. The same impression existed in Iowa.

Results of Plants. To make intelligible the results of past plantings in Indiana it is necessary to recognize three degrees of establishment.

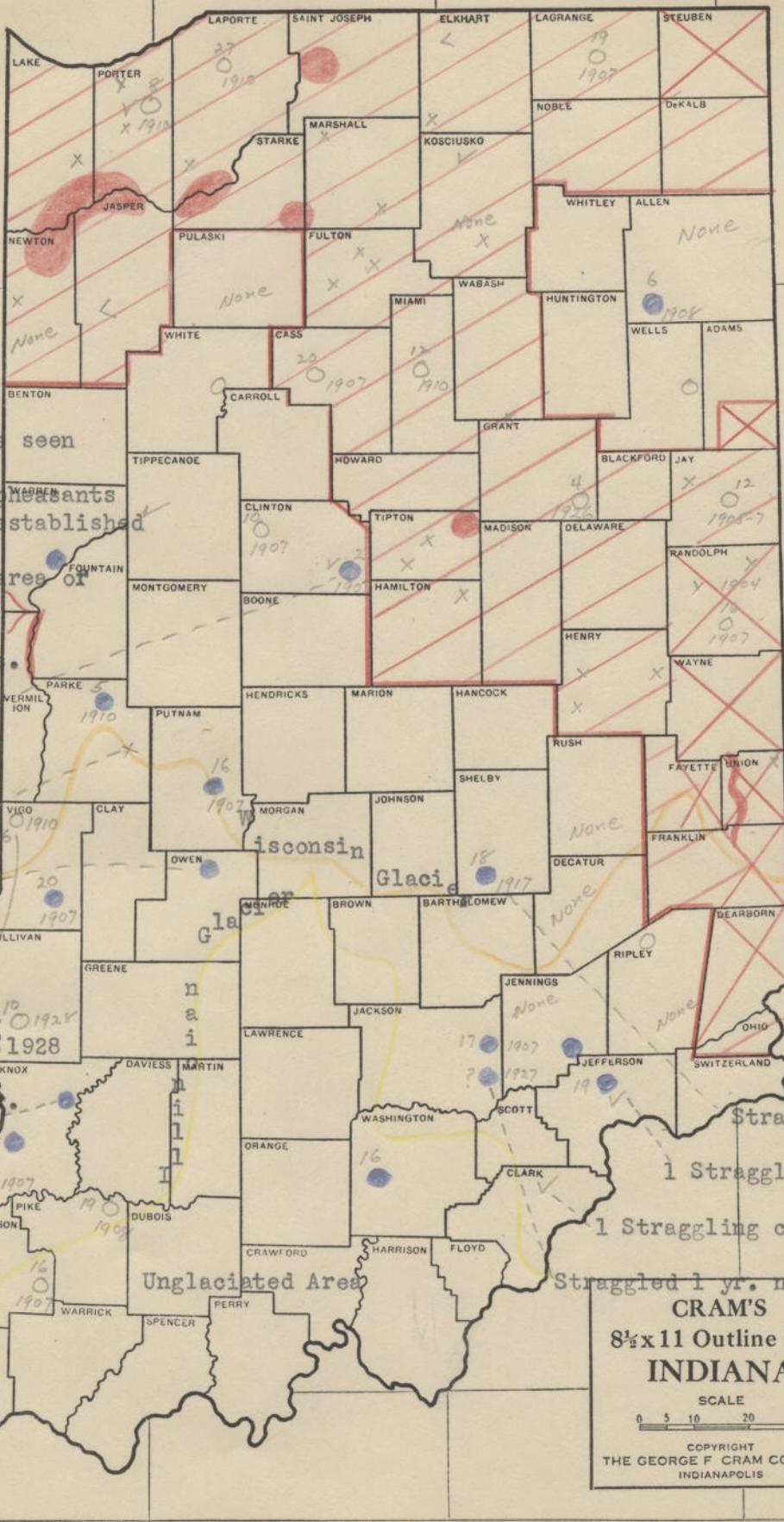
1. Concentration areas containing a continuous and numerous population of pheasants, the boundaries of which were determined (shown in solid red on Map L).

2. Stocked counties. Pheasants generally distributed but not necessarily in continuous or numerous populations. Shown by heavy crossed lines on the map.

Map L: Ringneck Pheasants

LEGEND

- 8 Pheasants planted in 1910
- Result of plant not known
- Plant failed
- X Pheasants established in wild state
- ✓ Stragglng remnants
- < Drift pheasants seen
- ✗ Area in which pheasants are generally established
- Concentration area of island of est.
- Scattered pheasants
- All cocks no broods seen
- A few in hills since 1910 (have broods)
- Straggled till 1924
- Broodseen 1929
- Broods seen in 1928
- Stragglng 1 yr. but no broods



CRAM'S
 8 1/2 x 11 Outline Map
INDIANA
 SCALE
 0 5 10 20 30 MILES
 COPYRIGHT
 THE GEORGE F. CRAM COMPANY
 INDIANAPOLIS

3. Counties containing pheasants in spots. Part of the spots are shown as black crosses on Map L, but no effort was made to get a complete record. The counties containing pheasants in spots are hatched lightly in red on Map L.

Why Are Pheasants Scarce? Alleged Decrease. It is clear from Map L that Indiana is so far a poor pheasant state. Why? Central and east Central Indiana closely resemble those parts of central Ohio, where the birds are abundant. Still they are there in only small numbers, if at all. Indiana sportsmen almost without exception ascribe this scarcity to illegal shooting, but there has certainly been as good, if not better, law enforcement in Indiana than in Illinois and Ohio, where poaching has not prevented the establishment of thriving populations over much larger areas than in Indiana. Poaching must therefore be discarded as an easy but insufficient reason for the lack of pheasants in Indiana.

It is particularly puzzling to find so few pheasants in the Lake Region, which is their stronghold in Illinois. We have here the same pot-hole swamps and reedy lakes, interspersed with farms and idle real estate which characterize the region northwest of Chicago in which they are abundant. Yet in Lake County there is hardly a single bird until one reaches the Kankakee. Everybody lays this to the heavy hunting from Gary and the other steel towns, but the same heavy urban populations lie adjacent to the region northwest of Chicago.

In the Illinois report it was suggested that the quail-less area near Chicago might be due to abundance of pheasants. The absence of pheasants from the quail-less area of Indiana (compare Maps C & L) substantially rebuts this interpretation.

It is clear that no birds survive on the unglaciated area and there was a lesser tendency to survive on the old Illinoian Drift than on the new Wisconsin drift. The glacial rule, however, while it holds water in all states so far surveyed, is evidently in itself not a sufficient criterion of good range. As in the case of Hungarians we may have to search for additional and less obvious factors. The argument for such research, however, will not be entirely clear until it is ascertained whether the recent plants make any such substantial change in the status quo.

Observers along the Ohio are of one mind in believing that pheasants have decreased during the last ten years. A less conclusive report of decrease is prevalent in Kosciusko County, where pheasants are said to have been abundant about 15 years ago. Near Kankakee, Ill. they are also said to have been more abundant 10 years ago than now. All of this decrease is ascribed to shooting. In the Kankakee region it might more logically be ascribed to removal of coverts, but this would not hold for Kosciusko County or the Ohio line. The problem presented must be left as an unanswered one to receive the attention of research fellowships studying this bird.

Stragglers and Relation to Brush. A careful interpretation of the marginal notes on Map L shows a tendency for failed plants to disappear immediately in the south, to survive as non-breeding old birds a little further north, and to raise broods but eventually go under as the boundaries of the established range are approached. One noteworthy case was encountered in Brown County where breeding birds are found on the state game preserve on the extreme boundary of the Illinoian Drift. These birds are said to inhabit the high cultivated ridges characteristic of the Brown County hills and to be fairly abundant. This country is entirely different from any successful

pheasant range heretofore encountered and if it were not for the recent revision of the glacial boundary by the state geologist it would have the appearance of being unglaciated territory. The cultivated ridges are surrounded by great areas of forest and brush.

Most of the stragglers noted on Map L inhabit dense brush the year around. The same phenomenon was observed in the southerly stragglers of Hungarians. What it means I am entirely unable to determine. It seems unlikely that the southern Indiana hills can ever be made successful pheasant range, but if the reason for the exceptional behavior of pheasants in them can be made known it might throw light on the birds elsewhere.

Phenology. The following fragments of information were obtained:

Baker found a pheasant nest in Wayne County on May 30, 1929, with an incomplete clutch of eggs.

Konya saw a hen with chicks just able to fly in St. Joseph County about April 28, 1929.

Miscellaneous Life History. Greyerson, who raised and liberated pheasants near Vernon in Jennings County, says that in that region they roost in trees nearly all the time, choosing any kind of a tree and roosting quite high up. He states that this corresponds with their habits in Denmark. Beebe reports roosting in trees in part of the west Asiatic range but not, to my knowledge, elsewhere.

Only one complaint as to crop damage by pheasants was encountered, and this was near Argos in Marshall County.

Silver Pheasants. are reported by Pressler to have bred and survived several years in a wild state 3 miles southeast of Connersville in Fayette County.

<u>Observer</u>	<u>County</u>	<u>Season</u>	<u>Can Flush</u>
Wiegeman	Steuben	Quail Hunting.	12-15 per day
	Newton	Chicken Hunting.	6 per day (west of Enos)
Baker	Randolph	Fall	4-5 per day by 4-5 men "driving."
Cass & Parks	Elkhart & Kosciusko	Quail Hunting	Saw only 12 in 30 days quail hunt (Near Nappanee).
Mauzy	Kosciusko	Fall	4-5 (?)
Hoover	Fulton	Quail Hunting	0-5 per day.
Treffs	Wills (ILL.)	Early Fall	4-15 per day seen by dog trainers N. of Peotone.
Buckler	Kankakee	Fall	1-2 per day if skillful
Hancock	Parks	Fall	3-4 (S. of Rockville)

Game Farms & Egg Distribution. The state operates no game farms, the present plantings being made through commercial (Wallace Evans) eggs distributed to sportsmen's organizations, who in turn take the responsibility for distribution to farmers for hatching. This seems a business like and conservative procedure.

The Terre Haute Walton chapter operates its own farm south of Sanford.

The present egg-distribution policy dates from 1927, the number put out being:

1927-----	1,674 eggs.
1928-----	10,040 eggs.
1929-----	

The 1928 reports indicate that 67% of the eggs hatched and 30% were turned down as 7-week birds.

11. Prairie Chicken.

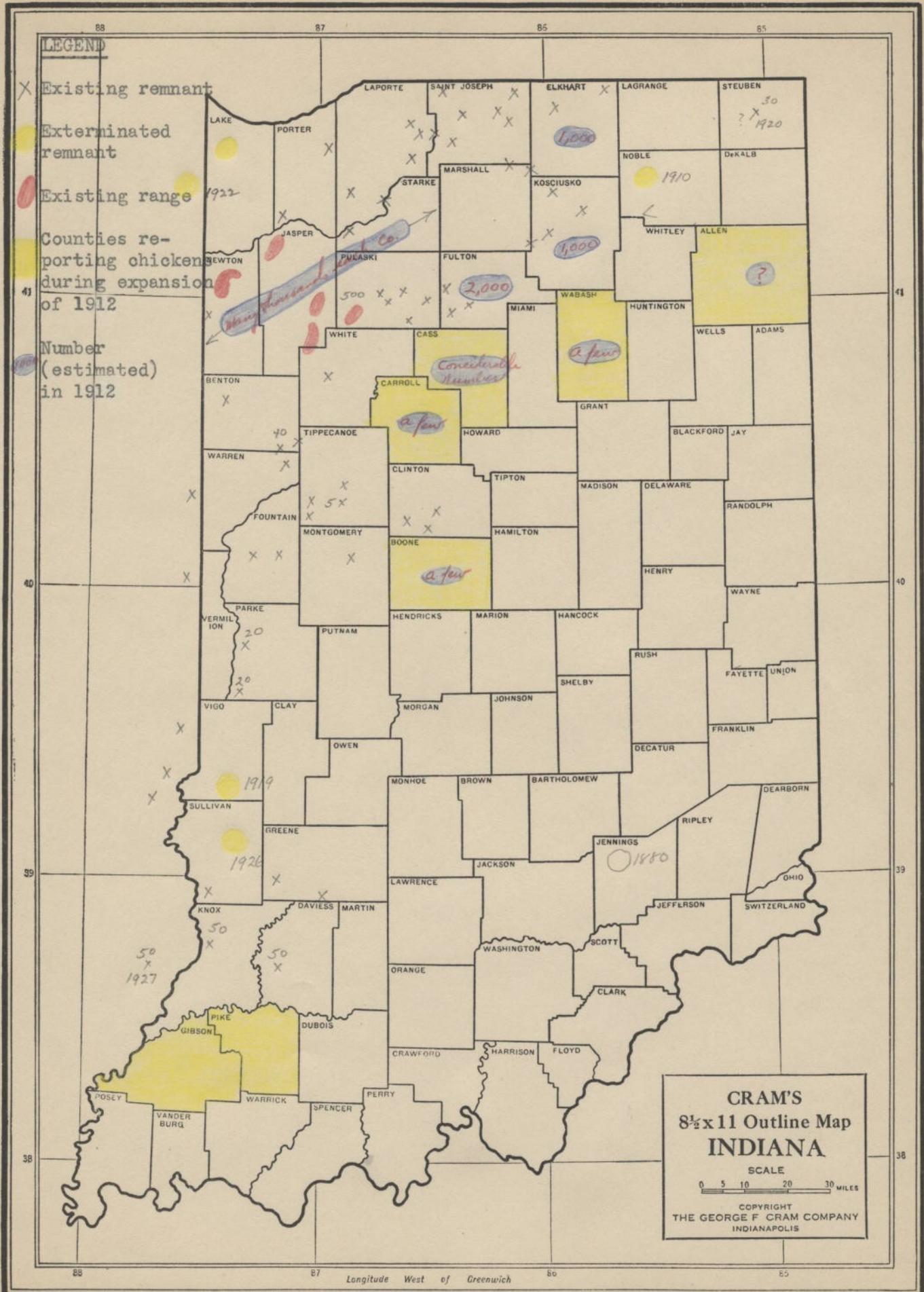
History. As might be expected from the amount of original prairie, Indiana seems to have been intermediate between Illinois and Ohio in the original abundance of chickens. Cockrum in his "Pioneer History of Indiana" (1907) said the prairie hen "was quite common up to 40 years ago in the prairie sections of the state and in the timbered region for many miles around the prairies, but there are now very few to be seen."

Since Cockrum in other parts of his book emphasizes the great original abundance of other species of game, the moderate phrasing of his statement on chickens may be taken as evidence that he never saw great numbers of chickens.

What he means by "the timbered region for many miles around the prairies" is doubtful. He may mean that the chickens followed the clearings into the forest wherever they became large enough to offer suitable range, or he may mean that chickens were native to the many small prairies of savannas which seem to have occurred in the transition zone between the forest and the continuous prairie, and also along the Wabash. Probably he means both, since chickens penetrated as far as Jennings County about 1880 (see Map M), I do not know of any savannas occurring that far toward the southeast. As will appear later the first great falling off in abundance of chickens occurred about 1870 or 1880, which corresponds to the information collected in Illinois.

The reports of the Conservation Department contain a definite record that chickens reached a very low ebb in 1909, followed by a surprising comeback by 1912. Commissioner Miles, in his 1913 report,

Map M: Prairie Chickens



records that the 1909 legislature closed the season until 1915 because at that time there were only a few chickens left. They were in the prairies adjacent to the Kankakee. Very few people, he says, knew that there were any left at all. He states that by 1912 the birds had spread eastward across the state as far as the counties shown in yellow on Map M. Estimates of their 1912 numbers were made for a few counties and these are shown in blue ovals on Map M. Miles concludes (1921) that "at least one third of the 92 counties now have chickens and there are certainly more than 100,000 in the state."

Present Distribution. Open Season. Present isolated bunches of chickens are marked on Map M by crosses and present continuous ranges are shown in solid brown. It is evident that 7 counties (in yellow) which had chickens in 1912 now have none. The 5 regular ranges shown in Newton, Jasper, and Pulaski counties possibly now contain up to 1,000 birds each. While the birds are regularly hunted during the 15 day open season which has prevailed since about 1915, I did not gather the impression that great numbers are killed. This is probably due to the late date (last half of October) by which time the birds are strong and wild. I doubt the advisability of continuing an open season, however, unless and until refuge coverts are provided/

I have the general impression that there are not quite as many chickens left in Indiana as in Illinois, but that the total numbers are not dissimilar. There seem to be fewer recent exterminations of isolated bunches than in Illinois.

High and Low Years. Commissioner Miles ascribes the 1912 comeback to the efforts at law enforcement and the establishment of leased preserves by the Conservation Department.

At that time this interpretation of the facts was undoubted-

High and Low Years in prairie Chicken
Indiana

<u>Year</u>	<u>Low</u>	<u>Average</u>	<u>High</u>	<u>Evidence</u>
About 1870	low			<u>Cockrum</u> , "Pioneer Hist. of Ind." 1907. says: "was quite common up to 40 yrs. ago" (1870).
Up to about (1880 ?)			high	<u>Berst</u> says disappeared from Turkey or Prairie, Kosciusko Co. all at once, about 50 yrs. ago (1880).
1894			?	<u>Coffel</u> killed a drift bird in Jay Co.
About 1907	low			<u>Cockrum</u> , "Pioneer Hist. of Ind." 1907, says: "now there are few to be seen."
1909	low			<u>Miles</u> , 1913 reports, says none left except a few on Kankakee. Season closed till 1915.
1912			high	See Map M. <u>Miles</u> , 1913 report says "there are certainly more than 100,000 in the state."
About 1915			high	<u>Decker</u> remembers "comeback" in Pulaski Co. about 1915.
About 1919			high (?)	<u>Stull</u> says many in Davies Co. 10 years ago. <u>Gude</u> says great comeback of chickens in Crawford Co., Ill. about 10 years ago.
*x 1925			high	<u>Wright</u> says 1925 was high year in Jasper Co.
1927	low			<u>Smith</u> : 30-40 birds on his farm in Fulton Co. fell off to 3-4 birds 2-3 yrs ago (1927)
1928		average		<u>Decker</u> says less in Pulaski Co. than 4-5 years ago.

ly justified, but the accumulating evidence that the prairie chicken is a cyclic species now makes it necessary to examine their fluctuations in abundance in relation to the fluctuations which seem to take place throughout the continent in all species of the grouse family. The limited data gathered in Indiana is not of itself sufficient to make such an examination, except to point out the fact that the 1909 "low" recorded by Miles corresponds roughly to the 1907 "low" well established for ruffed grouse, while the 1912 "high" recorded by Miles has its counterpart in ruffed grouse, and also in sharptail grouse in northern Minnesota. A complete analysis of the Indiana data will not be attempted until it can be combined with the Illinois data, and the Wisconsin data to be obtained this summer. As a tentative record, however, the Indiana data is given in the attached chart.

It hardly needs pointing out that the data back of 1909 are very flimsy, and not worth recording except to ~~the~~ ^{be} later compared with information from other states.

No evidence was found to indicate whether there was a low period corresponding to the 1917 low in ruffed grouse. The Illinois report, however, shows a considerable number of exterminations in that state about 1916, and this same depression may have extended to Indiana.

It is important to establish whether the prairie chicken is a cyclic species, because this fundamentally affects the probable returns from management efforts. The measures needed for management are discussed in the next sub-caption.

Prairie Chicken Management. At least part of the remaining establishments exist on cleanly cultivated farm lands with no swamp

grass or other yearlong coverts except occasional ditch banks. This same tendency to survive on cleanly cultivated lands was noted in Illinois, and constitutes evidence that even a modest scattering of state-owned refuge coverts might restore a considerable stock of chickens to Indiana. This hopeful fact, combined with the existence of many sandy or peaty drained swamps of little or no value for agriculture throughout the Lake Region, and combined with the fact that the pheasant program demands the acquisition of a similar system of refuge coverts, justifies me in definitely advocating the inauguration of a state refuge system.

The leased refuges tried in the past, while they probably have some value, cannot be regarded as a satisfactory substitute for state owned refuges because there is no way to assure the perpetuation of coverts, which in the case of both pheasants and chickens are of more critical importance than the mere control of shooting. As will be brought out under Waterfowl, part of the state-owned refuges could furthermore be successfully re-flooded for waterfowl purposes without hurting them for chickens and pheasants.

Even should the prairie chicken prove to be subject to periodic fluctuations and to this extent less attractive as a management venture, the value of such a system of refuges for pheasants alone would justify their acquisition.

Everything points to the conclusion that the prairie chicken is and always has been a mobile bird with a long cruising radius, and if he can be provided with a few dependable coverts during winter and early spring, he will use a large surrounding area for nesting and feeding purposes. In broad terms, one or two state refuges in each chicken county might serve to indefinitely perpetuate this splendid species.

Life History Data. The following fragments of information were gathered:

Daugherty dug up some red fox dens in Clinton County and found them full of prairie chicken bones. The heavy infestation of foxes in the Kankakee marshes makes this observation worth following up. The prairie chicken survey recently started by Wisconsin will make a special effort to examine the relation of foxes and chickens.

Smith has found dead chickens which had flown against ordinary barbed wire fences and also telephone wires. Fatalities from telephone wires are frequent, but I have not previously encountered a case of flying against ordinary fences.

Original Range. How far beyond the 1912 spread chickens ever occurred in Indiana is a matter of at least academic interest. Their occurrence in Jennings County is recorded on Map M. Newsome, who grew up on a farm, thinks there never were any in Bartholomew County. Decker knows of none ever occurring in Wells County, nor Goodrich in Randolph County. Coffel, a competent ornithologist, killed one in 1894 on a cranberry marsh, 4 miles west of Pennville. This bird was probably a drifter and may indicate a period of abundance in other parts of the state about 1894. Hunt knows of no chickens ever occurring in Wayne County.

12. Waterfowl.

Graphic information on migratory birds appears on Map N.

Clubs. The only dependable waterfowl shooting left in Indiana occurs on the Hovey Lake Club situated in the extreme southwestern corner of the state at the Junction of the Wabash and the Ohio. (Clem Schenk, pres., Mount Vernon, Indiana). This club leases a 600-acre lake, which is supplied with back water from the Ohio River. Mallard and other puddle ducks are the prevalent species.

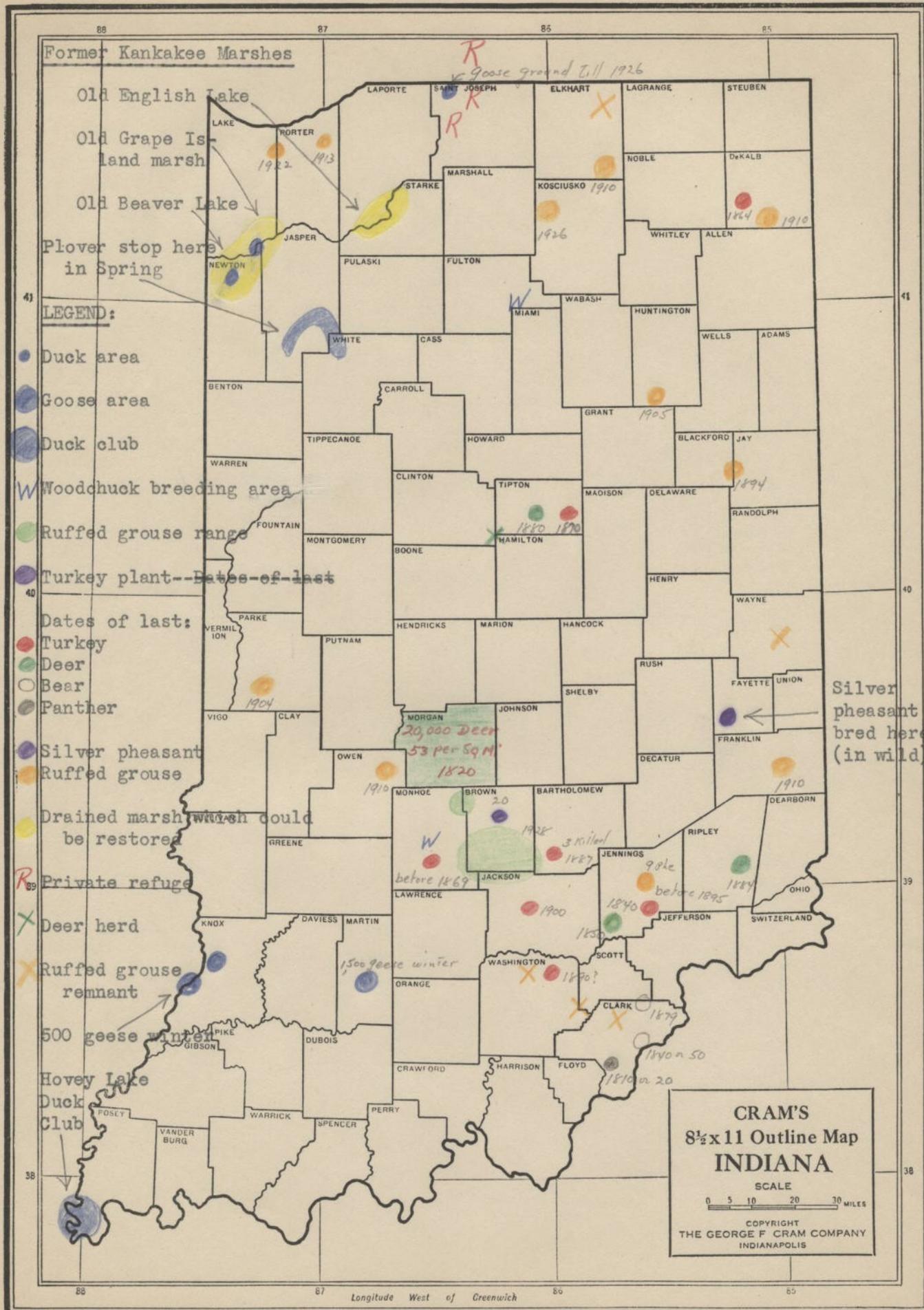
There is a small and probably temporary club on Headley's Lake near Lafayette.

Lake Region: Need of Refuges. The many remaining lakes in northern Indiana have evidently deteriorated to the point where most of them are merely mudhen propositions. A few ducks are killed on the lakes adjacent to LaPorte. Many of the northern lakes have the appearance of being excellent duck waters and most of them contain many ducks in spring. From this evidence it would appear that the absence of fall ducks is a straight case of "burning out," and that the remedy is refuges supplemented by feed. There is said to be some increase in breeding ducks in the lake counties during recent years. Many of these lakes are surrounded by cottages built on privately owned lots, which, of course, makes the inauguration of refuges difficult except by state action. It would seem to be well worth while for the state to at least experiment with the duck refuge idea on these lakes.

There is a state refuge on the game preserve in Brown County, but no surrounding water or feed. There is also the nucleus of a state refuge on the old English Lake, which will be discussed under the next caption.

Private waterfowl refuges are maintained by the South Bend chapter

Map N: Waterfowl & Rare Species



of the I.W.L.A. (This is described in Appendix E) by Notre Dame University, and by a farmer near South Bend. The first is described in a later section. Kankakee Marshes. It, of course, needs no repetition here that the Kankakee marshes were originally one of the finest waterfowl areas on the continent. Drainage of these marshes started about 1900 and is still in progress. There is a noticeable tendency, however, for the public to be skeptical about the agricultural value of the drained lands on the Kankakee, a growing consciousness that either the original marsh or a restored marsh would have a much higher economic value to the local community than is now offered in the drained or semi-drained condition. The proximity to Chicago, and the certainty of almost yearlong recreational use for fishing and waterfowl, plus economic use in the form of fur, adds an economic impetus to the proposal for marsh restoration.

I saw only the Beaver Lake section of the Kankakee, lying between Knox and Lake Village. There is practically no cultivation on this area, which constitutes practically a township of idle sedge and grass land underlain by pure sand. It is said to be feasible to restore Beaver Lake through the erection of a single dam, but such restoration will re-flood the concrete road which has recently been built across it. 50,000 acres of the Beaver Lake section are owned by Mrs. Conrad of Lake Village.

The Grape Island section is mostly owned by the Indiana Land Company.

The Conservation Department has acquired a nucleus of land in the old English Lake.

No special inquiry was made as to the financial status of encumbrances of Kankakee lands, but it is understood that much acreages can be had for around \$20 per acre.

There is at present no game on the Kankakee marshes except a few temporary ducks and geese, a fair stocking of pheasants and prairie chickens,

and one colony of Hungarians. The heavy infestation of foxes and coyotes, which scour the surrounding counties with the Kankakee marsh as headquarters, in part offsets the value of such little game as remain on these marshes.

Geese. A maximum of 2,000 geese make a short stop at Beaver Lake and Grape Island during the fall. A maximum of 500 winter on a sandbar in the Wabash above Vincennes, and another group, running up to 1,500, winter on the east fork of the White River in Martin County. The outstanding need of each of these areas is refuges, ^{as} ~~and~~ evidenced by the fact that a former wintering ground on the Michigan line above South Bend is now abandoned by reason of being "burnt out."

Plover. The plover area shown on Map N in Jasper County is used by these birds in spring only, but apparently nearly every year. Thousands are said to have visited this area during April or May 1929. They are locally called Golden Plover, but ornithologists inform me that the occurrence of golden plover in this locality seems rather improbable. They may, therefore, actually be Black Breasted Plover. Many are illegally killed. Since this is an open prairie country with much blue grass, and is used principally for stock feeding, there is every prospect that this area would be permanently used by plover if offered more adequate protection.

Upland plover are said to breed between Valparaiso and Gary. The identification was not verified.

Woodcock. Map N shows a few breeding areas which were heard of incidentally during the survey. In addition woodcock are seen but not known to breed in Starke, Rennsalaer, and Jasper counties.

Jacksnipe. Numerous inquiries as to whether there was any fall jacksnipe shooting left in Indiana failed to locate any, although many observers reported them plentiful in spring. It is not clear why there should not be at

least a few jacksnipe in fall near some of the marshy lakes unless, as will be brought out in the Wisconsin report, there has been a serious decrease in this species.

Wild Rice. The Tippecanoe was of course originally a famous rice stream. Mannfeld says the rice occurred from Warsaw down at least to Rochester. Since the Kankakee was a rice stream at its junction with the Illinois it seems probable that rice formerly occurred throughout its headwaters. Parks says there was formerly rice southeast of Nappanee. Rice is said to be coming back along the Tippecanoe near Mentone.

Doves. Hoover reports a great many doves near Rochester in Fulton County. This is about where the occasional patches of sandy country characteristic of southern Indiana have their beginning, and corroborates the observation made in the Iowa reports that the abundance of doves is greatest in sandy districts.

There is no open season on doves. There are hardly enough to justify one.

13. Rabbit and Squirrel.

The attached table gives miscellaneous facts on the history and status of rabbits in Indiana as collected from the most competent observers. The map data on rabbits are on the quail map, Map C, under the section on quail.

High and Low Years. The spotty nature of rabbit shortages in the North Central States is illustrated by the fact that of 13 observers 8 remembered some kind of a shortage and 5 did not. Part of the 8 doubtless remembered mild fluctuations due to heavy rains or unfavorable weather, which would not necessarily imply the existence of disease.

1928 Disease Area. There can be no doubt, however, that small areas are sometimes swept by killing diseases. Burtsfield reports a shortage near Lafayette in 1927 in conjunction with human tularemia cases. Wheeler gave me a convincing description of a tularemia area near Kankakee in 1928. There is little room for doubt that there was a rabbit disease, probably tularemia, along the Illinois line during the last two years. This is roughly blocked out on Map C. No effort was made to completely canvass the presence of human tularemia cases in Indiana, but one was reported at LaPorte, which is in the same general region.

It should be emphasized that the finds so far indicate that the north central states cottontail rabbits are subject to only very local and sporadic shortages. It would therefore seem that warnings by public health authorities should be based on local sampling of local populations rather than on broadcasted warnings, as has been the case in the past. It is clear to me after talking with hundreds of sportsmen that the great majority took notice of the warnings circulated during the last two years, but failing to find any sick rabbits, are beginning

History and Status of Rabbits
INDIANA

<u>Observer</u>	<u>Remarks apply to:</u>	<u>Remarks</u>
D. A. Dunlevy	Clark Co.	Rabbits never very short since 1917.
V. O. Keith	Shelby Co.	Never less than 2/3 normal crop. Short years due to rain.
Oliver Neal	Brown Co.	Shortage in 1928 due to rains. Several other local men checked this.
E.C. Crowmer	Owen Co.	Very short in the fall of 1927. Back by 1928. Remembers no previous shortage. Less than 1/4 normal crop in 1927.
F.C. Mathers	Monroe Co.	Thinks have been decreasing last 10 years
Arthur Murray	Sullivan Co.	Crop always about the same.
Ivan Pressler	Tipton	Short crops occur but very local; not a whole county.
Frank Burtsfield	Tippecanoe Co.	Scarce 1927. More normal 1928. 2 human tularemia cases 1928.
Dr. Geo. Hunt	Wayne Co.	Scarce 1928 and all recent years; only seen 3 per day. Abundant 8 years ago. Thinks shot out
Chas. E. Baker	Wayne Co.	Rabbits hole up in bad weather. Males more inclined to bed out than females. 1927 very short in small spots.
E.J. Parks	Near Nappanee (Kosciusko Co.)	Very short 1928; 1/5 normal crop. No other shortage since 1900. Excess of males in 1928 bag. No disease noticed. Sees plenty of young. Hole up here in cold weather, especially in 1928.
Geo.W. Smith, Jr.	Kewanna (Fulton Co.)	Very short last 4 years. Kill only 2-3 per day; formerly up to 80.
Harry Decker	Pulaski Co.	Hole up in zero weather. Thinks Wabash River at Logansport is about holding-up line.
Harry Wheeler	Kankakee, Ill.	Rabbits nearly wiped out by a disease starting in Oct. 1928, and covering area from Kankakee to Streater. Had bright red livers with white spots. Saw sick rabbits himself in Jan. 1929. Boys caught many by hand.
Elmer Jamison	LaPorte Co.	1928 crop normal; no sick ones seen. After zero weather comes rabbits do not bed out.

to distrust their authenticity. The broadcast method may in this way actually expose many hundreds to disease, whereas local warnings would be more likely to be heeded.

Sex Ratio: Relation to Bedding out. A new and possibly significant observation is that by Parks, who says that the rabbits near Nappanee in Kosciusko County bagged by him last fall ran an excess of males. This, taken in conjunction with Baker's observation that in Wayne County the rabbits which bed out in cold weather are all males, may indicate that north of the holing-up line shown on Map C, the males are more likely to bed out than the females, and therefore more likely to be bagged. It may also be that the males run longer before dogs than the females, or again it may be that diseases have a differential action on the sexes, which possibility is strengthened by the existence of diseases in the state during the year when the excess of males was alleged to exist.

Since cottontail rabbits are important game from the standpoint of the number of people participating in the sport it would seem worthwhile to run down this and other questions relating to life history and management through a special study of the cottontail. Without a doubt such a study would be widespread rather than local, and is therefore adapted to the facilities of the Biological Survey.

Squirrels. While Indiana has always been a famous squirrel state I have the impression that there is much less interest in squirrel hunting than in either Ohio or Mississippi. No valuable information was gathered on squirrels. Fox squirrels are of course generally distributed, while gray squirrels are confined to the brushy hilly timber of the south central region.

Red squirrels are found in St. Joseph County and also Fulton County and may be generally distributed throughout the northern section of the

state.

Original Scarcity of Rabbits. Cockrum makes the rather surprising statements that there were very few rabbits in Indiana in the early days. "There are 20 here now (1907) where there was one in 1840." This original scarcity was doubtless due to the same reasons which accounted for the original scarcity of quail, namely: too much timber, lack of grain feed, and abundance of predatory enemies.

14. Rare Species.

Map N under Waterfowl shows the graphic data collected on rare species in Indiana.

Ruffed Grouse. As in Ohio and Illinois, there is no evidence of violent fluctuations in abundance of ruffed grouse as between years, which fact contrasts strongly with the behavior of the species in its main range in the north woods. Only those Indiana observers who had hunted grouse in the lake states know what I meant by a grouse shortage.

Ruffed grouse are nearly extinct in the Lake Region and Till Plain, only 5 small remnants remaining in Elkhart and Wayne counties and on the Kankakee.

In the rougher parts of the southern region, however, a good many scattered remnants still occur, and in southern Brown County there is a continuous range apparently quite well stocked. There are probably additional remnants in the southwest corner of the state which are not shown on Map N.

The degree of abundance in the Brown County range is indicated by Gentry, who saw 6 during the week previous to my visit, and who says a man with a dog could flush 8 to 10 birds per day during the fall. He states that very few hunters succeed in getting any, in spite of the 40-day open season allowed.

In spite of the small kill it does not appear to be entirely conservative policy to continue an open season on a species which has suffered so radical a geographic shrinkage within the state.

Wild Turkey. Map N shows a plant of 20 turkeys made on the state game preserve in Brown County in 1928. It is of course too early to judge the results of this plant. One of its possible hazards is a local antipathy

against the preserve because it closed the accustomed hunting grounds of local residents. Curiously enough some of these threaten to work out their grudge on the turkeys that stray over the line of the state property.

Unfortunately the turkey stock released in Brown County is a mixture of Arizona and Dakota birds, which probably means that it is a mixture of the eastern and southwestern sub-species.

Not only state forests, but a skillful combination of forestry and game management, will be necessary to turkey restoration. The complete elimination of large "roost trees" for instance, might be good forestry but might injure the forest as a turkey range. The elimination of beech, because of its slow growth might be good forestry but bad game management because of the value of the beech mast. There is needed a "give-and-take" attitude on both sides and the active prosecution of research as the final arbiter of these and many other unsolved problems in the forestry-game field.

Map N shows that the original stock of turkeys was exterminated in the Lake Region at the time of the Civil War, the last one in DeKalb County having been killed on the day Richmond fell in 1864. The species disappeared from the Till Plain at about the same time but wild birds persisted in Brown County until 1909.

Cockrum in his "Pioneer History of Indiana" says that when the state was settled one could see many flocks of 50 to 75 turkeys each in a days hunt. He gives their food as sassafras, dogroot, and black gum berries.

Whitetail Deer. The beginnings of the quantitative idea in game management may be said to date back to 1820 in Indiana, because in that year Noah Major, one of the first settlers in Morgan County, made the first game census in North America. He estimated that there were 20,000 deer in

Morgan County, or 53 deer per square miles. This is a higher population of deer than now exists on the Kaibab Forest, and indicates the extreme productivity of the Indiana game range. This early deer census is referred to on p. 81, Vol. 1, of Carl Sandburg's "Abraham Lincoln."

Sandburg also says that George Doty in Johnson County killed 300 deer in the year 1871.

Cockrum says that deer fell off rapidly in Indiana after 1840, but evidently did not hold good in Johnson County. Cockrum states that the deer wintered on mast, and in the bluegrass section on the green grass as it came up under the mat of old grass during the winter season.

Map N gives the dates of disappearance of deer in several counties and indicates the extraordinary fact that the deer outlasted the turkey in Jennings, Tipton, and possibly Ripley, counties. I am quite sure that the opposite was the case almost everywhere throughout the present cornbelt. This seemingly academic fact may reflect some peculiar property of the Indiana range of importance to present species of game. It plainly indicates the same extraordinary productivity of the Indiana deer range which is reflected in Noah Major's census.

Map N shows one existing colony of deer in northwest Hamilton County. This stock originated by escape from a deer farm.

Bear. Cockrum says that bear in Indiana were originally nearly as numerous as deer (Which seems hard to believe) and that the settlers could not raise pigs until 1815 or 20. Map N shows that bear were exterminated from Clark County about 1840 or 50, which probably represents their last stand in the state.

Elk. Cockrum implies that elk occurred throughout the state and were larger than those to the southward in Kentucky, but smaller than those in Minnesota and the Dakotas.

Antelope. Cockrum makes the rather surprising statement that antelope "inhabited the prairie sections around Terre Haute and in the north and northwestern parts of the state--where the antelope was killed as late as 1810."

Buffalo. Cockrum states that buffalo were less numerous in the southern part of Indiana than they were on the Kankakee. This he ascribes to the panthers, which he says killed untold numbers. He definitely states that buffalo used the timbered sections of the southern part of the state, where they ate young cane which filled the creek bottoms and covered the foothills. The amount of cane in southern Indiana has probably been very greatly reduced by grazing as is the case in the South today. Cockrum says the last buffalo was killed 1810.

Extinct predators are covered under the section on predators.

15. Predators.

Such information on predators as is adapted to graphic expression appears on Map O.

Red and Gray Foxes.

Northward Migration. The most important fact I discovered during the Indiana survey was an apparent northward migration of red foxes about 1913, corresponding to the northward migration in Ohio described by Charlton and identical in date.

Commissioner Miles in his 1913 report, in discussing the disappearance of Hungarian partridges, states that they were preyed upon by foxes but also disappeared "in northern Indiana where there are no foxes." Since Hungarians were planted in most of the northern counties it may be inferred that Miles referred to the northern country as a whole and that foxes were either scarce or absent from that country at that time.

At the present time all observers agree that the Kankakee marsh section is badly infested with red foxes, and also with coyotes. The only information found as to when this infestation was first noticed is to the effect that it occurred subsequent to drainage (which began 1900), and seemed to date from a time when all the dead timber blew down and created tangles on certain areas. These tangles are regarded by local observers as the cause of the infestation.

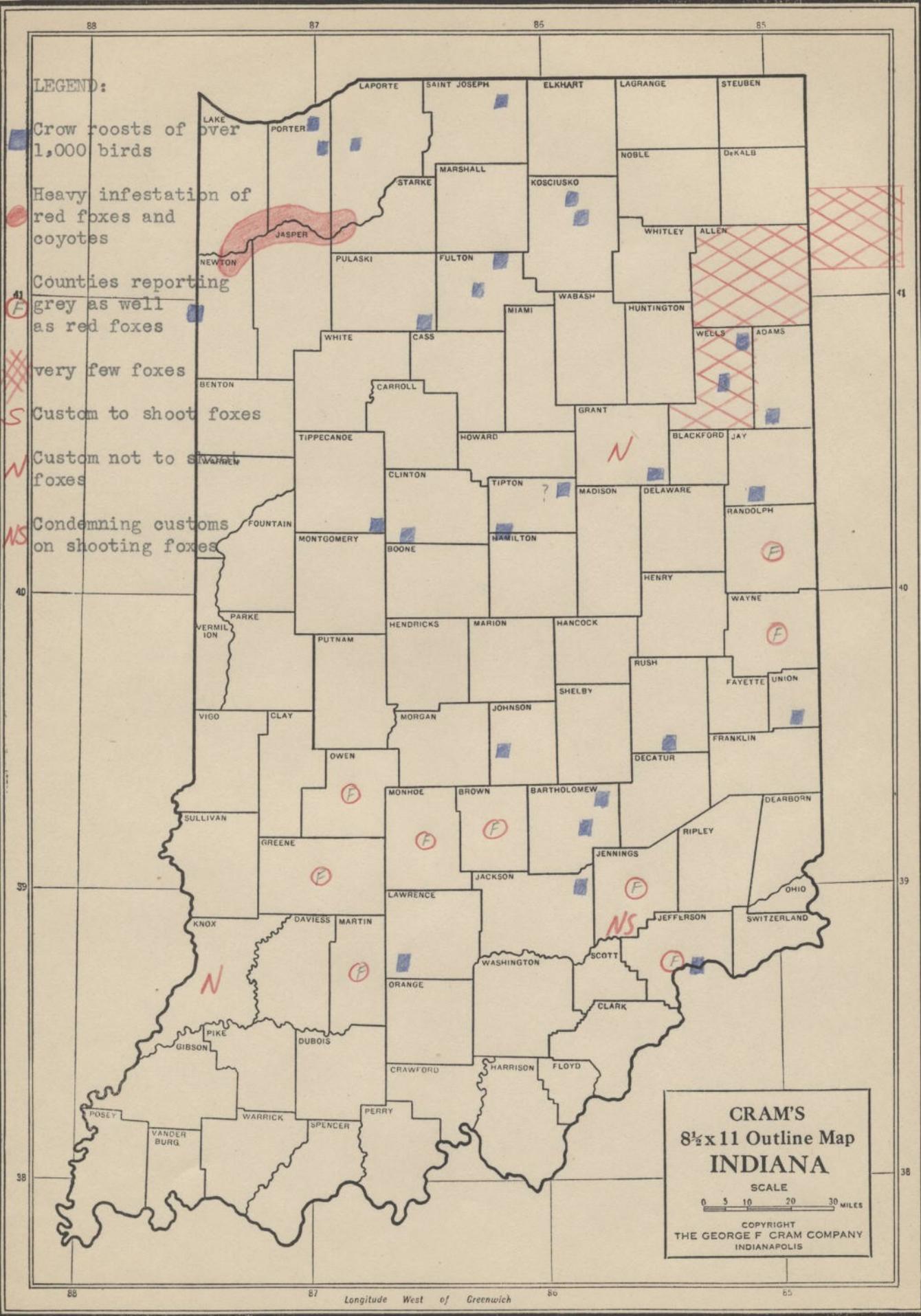
The Miles report may be accepted as evidence that the infestation began in 1913 or later.

Charlton, as quoted in the Ohio report, says: "there were no foxes in northwest Ohio until 15 years ago (1913), when they moved northwest and infested the Lake Erie marshes." This definitely dates the Ohio infestation.

Map O: Predators

LEGEND:

-  Crow roosts of over 1,000 birds
-  Heavy infestation of red foxes and coyotes
-  Counties reporting grey as well as red foxes
-  very few foxes
-  Custom to shoot foxes
-  Custom not to shoot foxes
-  Condemning customs on shooting foxes



CRAM'S
8½ x 11 Outline Map
INDIANA

SCALE
 0 5 10 20 30 MILES

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and the Miles report makes it seem highly probable that the Kankakee infestation began at the same time, and perhaps for the same reason, although that reason as yet remains obscure in both cases.

Relative Abundance of Reds and Grays. There appears still to be an area in northeast Indiana and northwest of Ohio where foxes are very scarce and all reds. Stover (see Ohio report) reports them scarce in Defiance County, while Fleming says they are much thicker in northwest than northeast Indiana. The counties known to lie within this nearly foxless area are hatched in red on Map O.

The following additional fragments were gathered on relative abundance:

More grays than red in Jefferson County (Greyerson); both plenty in Monroe (Mathers); once all grays in Knox, now mostly reds (Gude); ten reds to one gray in Wayne (Baker); grays disappeared ten years ago in Clark (Elrod); all reds in south Shelby and southwest Rush (Meith).

All counties ascertained to still contain gray foxes are marked with a brown circle on Map O. The prevalence of gray foxes is of more than academic interest because the low value of their fur leaves no large scale incentive for their control, and to this extent they are a more troublesome game problem than are the reds.

Fox Hunting Customs and Laws. Fox hunting sentiment in Indiana is strong enough to maintain a closed season on foxes from Nov. 20 to Feb. 10.

The map shows a few representative cases of where it is the custom for the local fox hunters to shoot or not to shoot the foxes they are hunting.

Crows.

Map O shows the approximate location of such crow roosts as I was able to learn about during the survey. No roosts under 1,000 birds were mapped. The total record may possibly show half of the large crow roosts in the state which are in current use during the winter season.

Neither the distribution of the roosts nor any other information that I was able to get indicates any radical difference between the north and south parts of the state as to winter abundance of crows. Since Indiana is one of the states in which migratory crows undoubtedly winter, this information is of value.

The impression was gathered that many crow roosts in Indiana are systematically shot, and that there has been considerable shifting of roosts from year to year, possibly because of this shooting; that there was no strong evidence of recent increase in either the resident or winter crow population, with possibly some reason to suspect a decrease. It would be of great value if Indiana ornithologists would make the same kind of systematic observations on crows as Jones has made at Oberlin, Ohio. Possibly such observations have been made without my encountering them. Time was lacking for a review of the ornithological literature of the state.

The following miscellaneous cases are worth recording, not because they prove anything in themselves, but as pointers for future observations.

Phillips saw a crow in May 1928 which flushed carrying a dead bird. Upon frightening the crow the bird was dropped and proved to be a warm dead hen quail. The quail may have been killed by some other animal and picked up by the crow, or it may actually have been a case of a crow killing a hen bird on the nest.

Heeley says that Issiah Miller, who owns a farm in east Grant County, protects crows because he believes they keep the grubs out of his 1,000 acre pasture, which has stood up for 50 years without renewal.

The standard county bounty on crows is 10¢, as fixed by state law, but not all counties offer and pay this bounty. Which counties pay and which do not was not ascertained.

Housecats.

Table P gives the specific local information obtained on house cats.

Abundance. It is evident from Table P that abundance varies considerably as between region, but there are not enough data to support any conjectures as to causes.

It seems possible that the prevalence of night hunting for coons has an actual effect in reducing the local house cat population. Many coon hunters are of this opinion.

Breeding in the Open. Vandewalle found a litter of kittens in a log between Scottsburg and Little York in Scott County about 1910. This was during the summer while squirrel hunting, as his squirrel dog located the den. Both of the parents were in the den and were killed. The 7 young were one-fourth grown. The log was located in a brush pile.

Parks found a litter of 3 young housecats in Freese's Woods just south of Nappanee in Kosciusko County about 1917. This was in May or June. The 3 young were in a hollow stump, and were one-third grown. The stump had all the marks of a permanent den and was 80 fods from a house.

In spite of these authentic instances of housecats breeding in the wild, it seems increasingly clear that such instances are exceptional, and that the feral house cat does not ordinarily breed in the open.

Sex Ratio of Feral Cats. Gude is of the opinion that most feral cats are toms.

Wolves.

Wolves are said to be steadily increasing in the region of the Kankakee marshes and the sand dunes in the northwestern part of the state.

Information on Harems - Louisiana
 Cate Per Eye Counts Miles Cat

Observer	Locality	Count	Miles	Cat	Remarks
D.A. Stenberg	Clark Co.	1/2			Will see a cat per 2 hunts, but only near farms.
Victorich	"	1			Seldom see more than 1 per night
Elrod	"	2			Only if dog likes to hunt cats.
John Vandevolle	Jackson Co.	1/3			Getting scarce due to killing by
J.C. Mathews	Stonewall Co.				Crow hunters. Used to see 2 per night
John A. Gude	Knox Co.	1			Saw none in 10 hunts last fall.
Arthur Murray	Sullivan				Wild cats are mostly tame.
Edward L. Hancock	Parke Co.	20	4	5	Found 1 cat in 5 days Quail hunting. '28
M.L. Neeley	Grant Co.				This is only an estimate
Swan Brewer	Lipton Co.	2-3	18	2	(In May)
Chas. L. Baker	Wayne Co.	2	11	1/5	This count in daylight, cats very bad,
Andrew Tonya	St. Joe.	140	25	6	Killed 17 of 25 cats seen.
E.J. Parks	Kosciusko	1	100	1	Found den with litter of 3 in hollow stump.
Red Burk	Sutton Co.	6	4	2	June 10, 1929, near Rochester
Geo. W. Smith	St. W. Sutton	6			This is an experienced & conversative observer.
Elmer Jamison	La Porte				Very few cats. Seldom heard in

Wildcat and Panther

The former distribution of ordinary wildcats is puzzling. None of the many competent observers interviewed in the southern part of the state had any recollection of their occurrence. On the other hand, Cockrum says this species "was very plentiful in all sections of Indiana." As brought out in the Illinois report they still occur in southern Illinois and drifting individuals are even found in northern Illinois.

Cockrum says that the last panther was killed in Washington County in 1830 in a "dagger trap." In other words, this species lasted nearly as long as the deer which were its principal prey. Map N shows that the last panther in Clark County was killed between 1810 and 1820.

(B) Land Practice and Shooting Privileges in
Indiana.

16. Summary. As in neighboring states, most farms are closed to public shooting.

There are no public shooting grounds as yet.

The shooting which remains on private lands is largely the result of accident, rather than of any deliberate effort by the owner to raise game crops.

The efforts of public agencies to raise game crops by releasing seed stock on private lands, has been of little avail because of inability to control the environment offered by such lands.

The fundamental need is for all parties at interest to recognize that whoever is to raise game must control the environment as well as provide the seed.

Once this principle is recognized, the question of who is to raise or harvest the crop will largely answer itself.

The farmer is the only one who can control environment on farms, because controls are the by-product of the farming operation. The public can no more raise farm game than farm corn. Once game management on farms is recognized as the farmer's job, the public ought to recognize his right to compensation for whatever surplus hunting he chooses to dispose of.

On the other hand, the state is the only one who can (or does) control environment on large forests, because controls are the by-product of forestry operations. (Timber owners theoretically can, but do not as yet practice forestry.) Once game management in forests is recognized as a state job, the impetus to the program of forest acquisition will be strengthened to that extent.

Posting and Charging. Table Q shows the present status. Map C and N show the small growth of clubs to date. The expansion of productive clubs and preserves should certainly be preferable to the relatively unproductive posted farms which now prevail throughout the state. If land is closed to public hunting anyhow, the more game is on it the better the public is off.

As brought out in the Illinois report, the average shooter already burns up enough car mileage in his search for distant free shooting to compensate the farmer for better but nearer paid shooting.

Workability of Public Refuges. As in other states, many Indiana sportsmen hope to perpetuate upland game by state-owned refuges.

They fail to discriminate between species.

Refuges will work for pheasants and prairie chickens, especially where concentrated on (or headquartering in) swamps containing good cover or cheap land.

Public refuges will not work for quail, because of the lesser mobility of this species. The refuges would have to be so close together as to be impracticable of administration.

An understanding of this distinction is necessary to the growth of a workable system for management of game lands.

Table Q
POSTING AND CHARGING

Indiana

<u>Observer</u>	<u>Observation applies to:</u>	<u>Remarks:</u>
Geo. N. Mannfeld	Whole state	Knows of no upland clubs, or charging by farmers.
D.A. Dunlevy	Clark Co.	50% farms don't permit hunting, but only 2-3% have signs up. No lands been leased. No charging.
H. J. Furnish	Scott Co.	85% farms don't permit hunting, but some of these admit friends. No charging.
John Vandewalle	Jackson Co.	50% farms don't permit hunting, but only 33% have signs.
Calvin Purdue	Shelby Co.	Farms 33% posted. Knows of no charging.
H.D. Newsome	Bartholomew Co.	70% farms do not permit hunting. Very few posted.
Frank Gentry	Brown Co.	Indianapolis people lease farms near Trevlae in NE Brown Co., on Bean Blossom R. This is first case.
John A. Gude	Knox Co.	33% or more closed and posted. No charging.
Arthur Murray	Sullivan Co.	One farmer got \$5 per day for his quail shooting from Chicago sportsmen. Half farms closed; few signs.
Howard L. Hancock	Parks Co.	30% farms do not permit hunting; 20% posted.
M.L. Neeley	Grant Co.	50% of farms have signs up. Can hunt on most farms by asking. No charging or clubs.
Frank Burtsfield	Tippecanoe Co.	50% of farms posted. Local lake leased for duck hunting, but no quail leases.
Wm. Wiegeman	Allen Co.	Heard of one farmer charging 50¢ per day for hunting. No clubs.

Posting and Charging (Cont'd)

Indiana

<u>Observer</u>	<u>Observation applies to:</u>	<u>Remarks:</u>
Mr. Geo. Hunt	Wayne Co.	50% of farms do not permit hunting. No leasing or charging.
Andrew Konya	St. Joseph Co.	Farmers beginning to accept pay for quail shooting, but do so informally.
Tom Hoover	Fulton Co.	Half the farms are closed to hunting. Increasing. No leasing or charging as yet.
Harry Decker	Winamac	75% of farms do not permit hunting; 30% have signs up.
Harry Wheeler	Vermillion, Edgar & Clark Co., Ill.	Farmers charging 1-2.00 per day for quail shooting and forcing an extra low bag limit. Charge 50¢ per car for duck shooting along Kankakee river.
Peter Bozarth	Porter Co.	Nearly all farms closed and posted a/c hunters from mill towns.

19. Eroded Lands and Game Cover. Various degrees of land deterioration through erosion are found in every county in Indiana. Circular 90 of the Agricultural Experiment Station, entitled "The Washed Lands of Indiana" (M. L. Fisher, 1919) gives excellent pictures of this condition, but under-estimates the possibilities of deliberate revegetation as a means of control. As in other states, the enhanced game crops possible through revegetated drainage channels are not mentioned.

Skip plowing as a means of checking incipient gullies is mentioned and it is gratifying to observe the extent to which this practice has been actually adopted. Like other revegetated channels, the grassed gullies left by skip plowing intersperse the environmental types and enhance the game crop, especially the quail crop.

Except on those soils which raise pasture grasses readily, there is no feasible way to check existing erosion damage on a large scale except revegetation, and this had just as well be done in a manner which will not only conserve the soil but also raise game or forests.

20. Game Crops for Revenue on Marginal Farms. Agricultural authorities and publicists in Indiana are worried over the rate of abandonment of marginal farms and the financial, social, and educational problems presented by those not abandoned.

In 18 southern counties 405,000 acres were abandoned 1910-1925, while from 19 to 47 percent of each county constituted woodlands and wasteland. (See Appendix D).

In 29 southern counties less taxes were collected in 1928 than in Marion County alone, although these 29 with 4 others contain a quarter of the population and a third of the land area of the state. After school aid to these southern counties is allowed for, their financial status appears as even worse. (Figures taken from a letter from Col. Lieber to Governor Leslie, Mar. 1, 1929. Not reproduced because of its length).

The economic rehabilitation of these southern counties probably depends primarily on restoring their forests to productivity, and this need is coming to be recognized by public leaders. What is not recognized is that a smaller but much quicker return can be realized from raising game crops.

The large industrial populations of the cities of Indiana, Ohio, and Illinois present an almost unlimited market for any shooting produced on southern Indiana farms. The job of producing such shooting offers the farmer cash employment. This he is now inclined to seek by abandoning the farm and moving to a factory town.

It should of course not be overlooked that game management is an extensive operation. Southern Indiana farms, by a cultural investment consisting mostly of skill and labor, will yield a quail per acre per year, worth (at southern rates) 50¢ each for the shooting privilege.

As far as cash goes, the yield is net. One full-time man (judging by European standards) can manage 1,000 acres.

Quail management should be a substantial proposition either as a side-line cash crop for a going farm, or as a yearlong job for a farmer who has blocked up shooting rights on his own and neighboring farms. In either case the quail crop can, in broad terms, be made to pay the taxes on southern Indiana lands.

The average southern Indiana farm without management probably is not yielding over 1 quail per 5 acres per year. (See Tables D and D1). With management it should, in the average case, be possible to double the present yield the first year, and to reach full production the third year.

The risk of crop failure is an important consideration in any kind of farming. As already brought out under quail, a 50 to 75% winter loss may be expected in one out of 7 years without feeding. With feeding the severity of this loss ought to be substantially less. In addition, slight shortages from heavy rains may be expected every 3-5 years.

Summing up the whole case, it may be asserted that:

- (1) Quail will about pay the taxes on marginal Indiana farm lands if put under management.
- (2) Management requires time and skill but little or no cash.
- (3) The risk of loss is no greater than with other crops.

The marginal farmer usually has the time. Where shall he acquire the skill?

Many farmers already possess a natural aptitude for handling game, and could do very well with only a little printed instruction, such as

will be available in the report of the Georgia Quail Investigation.

In the long run, however, specific localized advice is as necessary for game management as for other crops. To develop and disseminate such specific advice is the natural function of the Agricultural College.

This is further treated under Section E, Game Research.

(C) The Conservation Public in Indiana.

21. Game Organization. Indiana is the first state so far surveyed having an up-to-date list of game organizations, (see 1926 Report, pp. 189), hence it seemed advisable to find out what these looked like on a map. The result appears on Map R. No organizations whose title indicated a primary interest in fish or trapshooting were entered.

The following conclusions seem warranted:

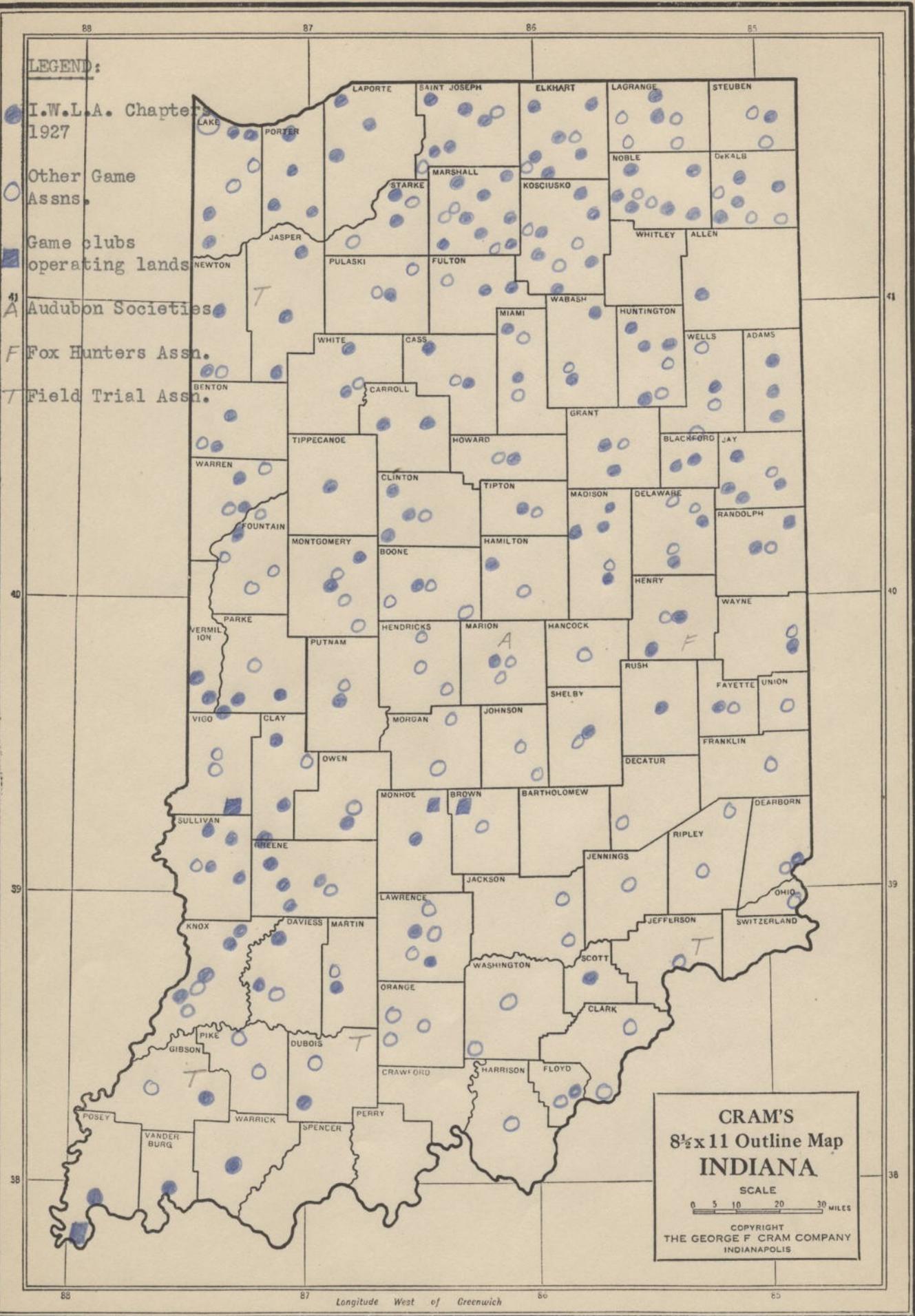
- (1) Game organizations are numerous and widespread, and have great potential power.
- (2) They are most numerous where people are most numerous, rather than where game is not plentiful.
- (3) Two or more organizations in one town is almost the rule rather than the exception.
- (4) The standard Izaak Walton chapter is more likely to succeed an industrial than in rural towns (doubtless because of the relatively high dues).
- (5) Land-owning or land-leasing organizations are much less numerous than landless ones.
- (6) The typical Indiana county has an Izaak Walton League and a Fish and Game Association at its county seat, plus two or more rural organizations centering at some lake or in some hunting township or village.
- (7) Only 4 out of 92 counties have no game organization whatever.

22. Organization Policy and Programs. Only one game organization was found (the Lafayette chapter of the I.W.L.A.) which showed evidence of coming to grips with the realities of the two fundamental game problems, namely, (1) environmental controls; (2) land relations. A great deal of splendid work is of course being done. My impression of the relative prevalence of program items is that the distribution of state or privately purchased pheasant eggs far outnumbered all other activities. In

Map R: Conservation Organizations

LEGEND:

-  I.W.L.A. Chapters 1927
-  Other Game Assns.
-  Game clubs operating lands
-  Audubon Societies
-  Fox Hunters Assn.
-  Field Trial Assn.



CRAM'S
8½ x 11 Outline Map
INDIANA

SCALE
 0 5 10 20 30 MILES

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 INDIANAPOLIS

addition, many have a winter-feeding project, and a few have game farms, refuges, "preserves", predator-control, or law-enforcement projects. This of course omits fish projects, parks, scout activities, etc.

One weak point is that farmer-participation is the exception rather than the rule, especially in the northern sections.

Another weak point is that fact-finding projects are nearly absent.

On the whole, however, the group-intelligence of Indiana sportsmen is high as compared with other states. I seemed to detect a little more open-mindedness than usual.

(D) Game Administration in Indiana

23. Organization. Chart 8, copied from the 1928 report, shows the organization of state leadership in conservation affairs, and is self-explanatory.

The budget and revenues of the divisions most closely allied to game are approximately:

<u>Source of Funds</u>	<u>Fish & Game</u>	<u>Forestry</u>	<u>Parks</u>	<u>Total</u>
Fish & Game Licenses	335,000			335,000
Forestry Mill Tax		100,000		
Dept. Appropriation (from general treasury)		15,000	?	182,000
Dunes Park Levy (per year for 10 years)			100,000	100,000
Clarke-McNary co-operation. (federal)		?		?
	<hr/> 335,000	115,000	?	?

The present department was created in 1919. Previous to that Fish and Game constituted a separate department.

24. Indiana Conservation is "Out of Politics." Indiana is one of the two States so far encountered where game work is substantially "out of politics." This is, of course, a relative term. The practical test of its meaning is whether the department is so organized and administered that:

- (1) Technical experts have been willing to enter its employ.
- (2) Policies can be carried out through a period of years without undue interference from political overturns.
- (3) Regulatory powers, purchase powers, and other discretionary authority is so exercised by administrative officers that the general public is confident that the objective is conservation.

The game division in Indiana qualifies as to (2); some of the other divisions as to one or more of the others. The point here is not to compare divisions, but to ask the question of whether Indiana if i t

CONSERVATION OF NATURAL RESOURCES

BY

THE PEOPLE OF INDIANA

THE GOVERNOR

RULES AND REGULATIONS

PUBLICATIONS

SCIENTIFIC COOPERATION

COOPERATION WITH THE FEDERAL GOV'T.

SCIENTIFIC RESEARCH

PURCHASE OF LANDS HISTORIC PLACES ETC.

CONSERVATION COMMISSION

DIRECTOR

ENFORCEMENT OF LAWS & REGULATIONS

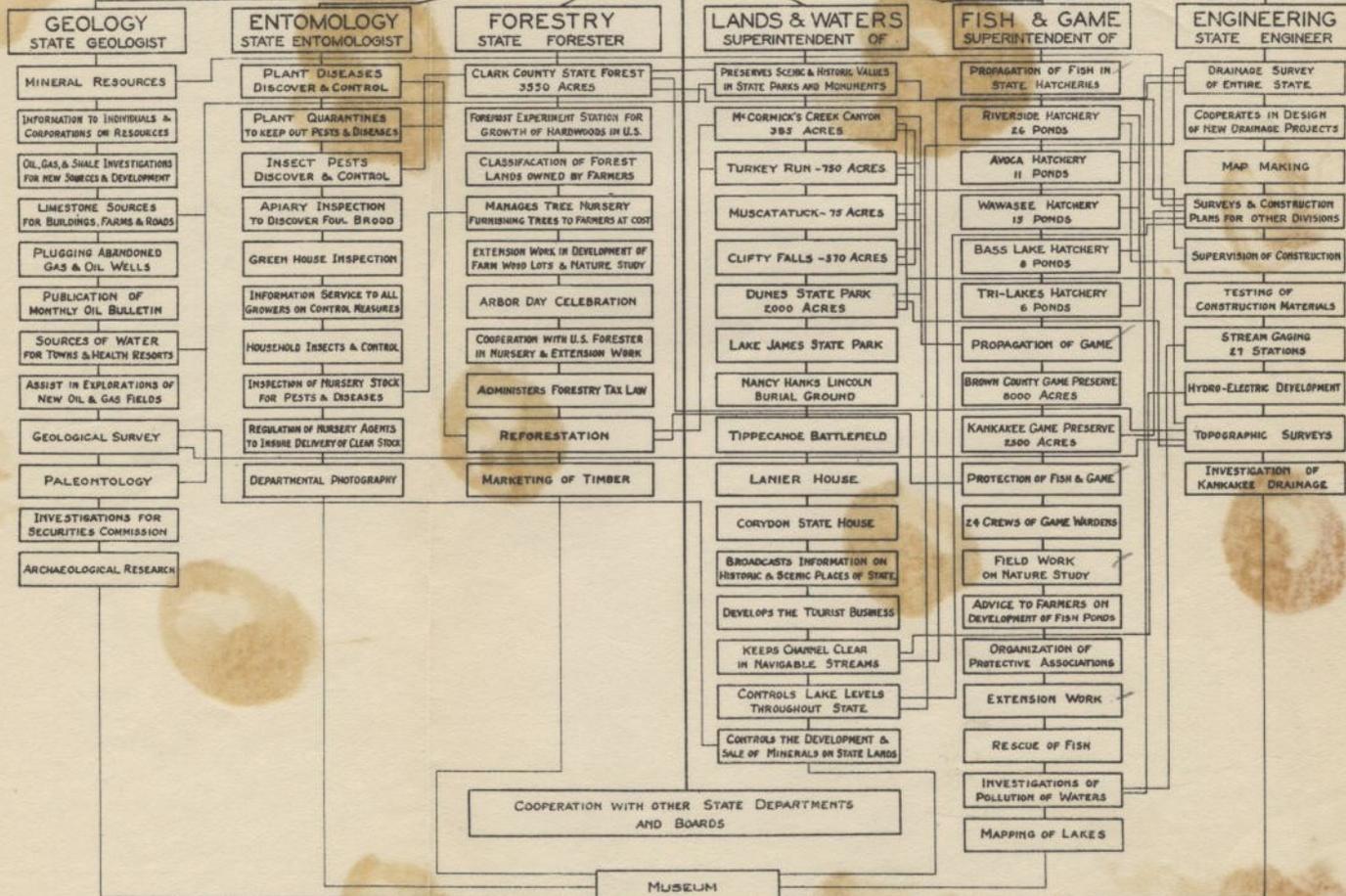
GAME WARDEN SERVICE

FILE CLERK

ASSISTANT TO DIRECTOR

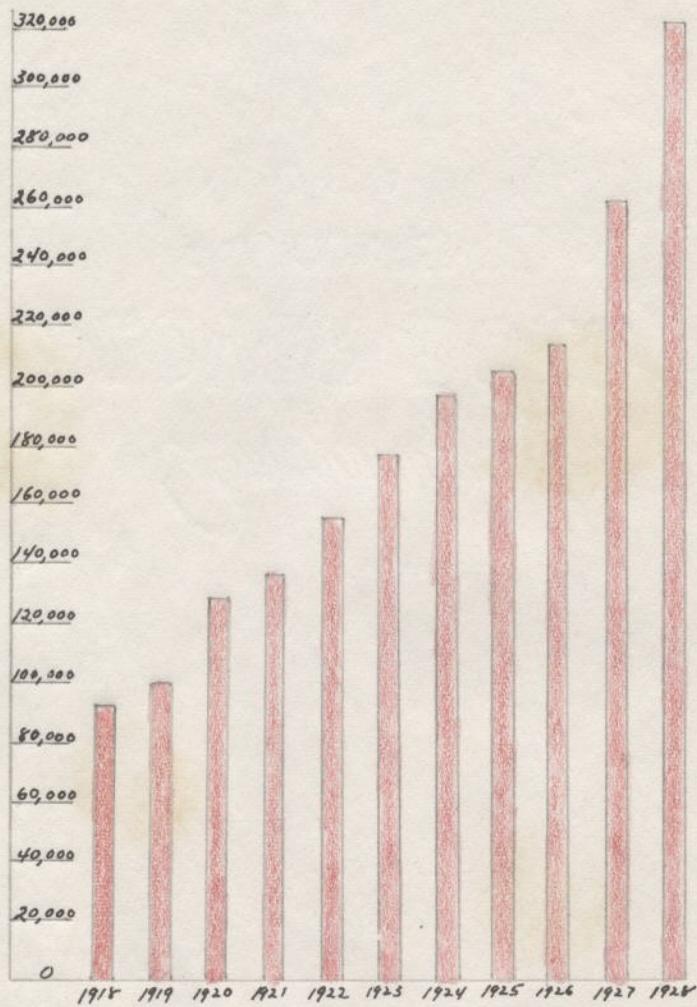
INFORMATION SERVICE

ACCOUNTANT



HUNTING AND FISHING LICENSES ISSUED

ANNUALLY DURING PAST 11 YEARS



adopted an advanced program in any kind of conservation work, could regard the present department of Conservation as a suitable place to build up the necessary machinery for its leadership and execution. The answer is that it could.

The name could not be said of any other state so far surveyed except Michigan. Most states would have to rebuild their official machinery before being able to safely start any really advanced program. This is often as big a job as the program itself.

This relatively satisfactory condition in Indiana is due not only to the sound organic act, but to the calibre of the director. Other states have equally good or better "organization charts," but are by no means ready to start work, due to the lack of executives.

25. Game Program. The present game program seems to be:

- (1) Revival of pheasant planting.
- (2) Feeling out the possibilities of "preserves" in the hill country, evidently with a view to working toward the Pennsylvania system.
- (3) Feeling out the possibilities of state acquisition and restoration of marshlands.
- (4) Defense of the quail season, winter feeding, etc.
- (5) Educational work in co-operation with National Association of Audobon Societies. Field work maintained.

Each of these items is sound and capable of expansion into an aggressive and adequate program. The expansions and modifications suggested elsewhere in this report are:

- (1) Pheasants. Drop the attempt to plant the southern counties. Embark on a swamp-refuge acquisition program for pheasants and prairie chickens. See Sec. A-11 and A-10.
- (2) Hill Country Refuges. Perfectly sound. No suggestions except more intimate correlation with forestry, and more public backing to get more funds and quicker progress.

- (3) Marshland Restoration. Perfectly sound. No suggestions except more public backing for quicker progress.
- (4) Quail. Defense of the status quo is insufficient. See sec. A-8 and Sec. E for detailed suggestions.
- (5) Education. This activity has been not as yet described. Sidney R. Esten is maintained, in co-operation with the Nat. Assoc. of Audubon Societies, to do educational work in schools and public groups. 379 talks were given in 1928, 224 of which were at schools. The project is obviously of great and fundamental value.

It should be understood that these "suggestions" are not for publication, and are for the makers of the Survey. Their purpose is to illustrate a condition, not to offer unsolicited advice to the state of Indiana.

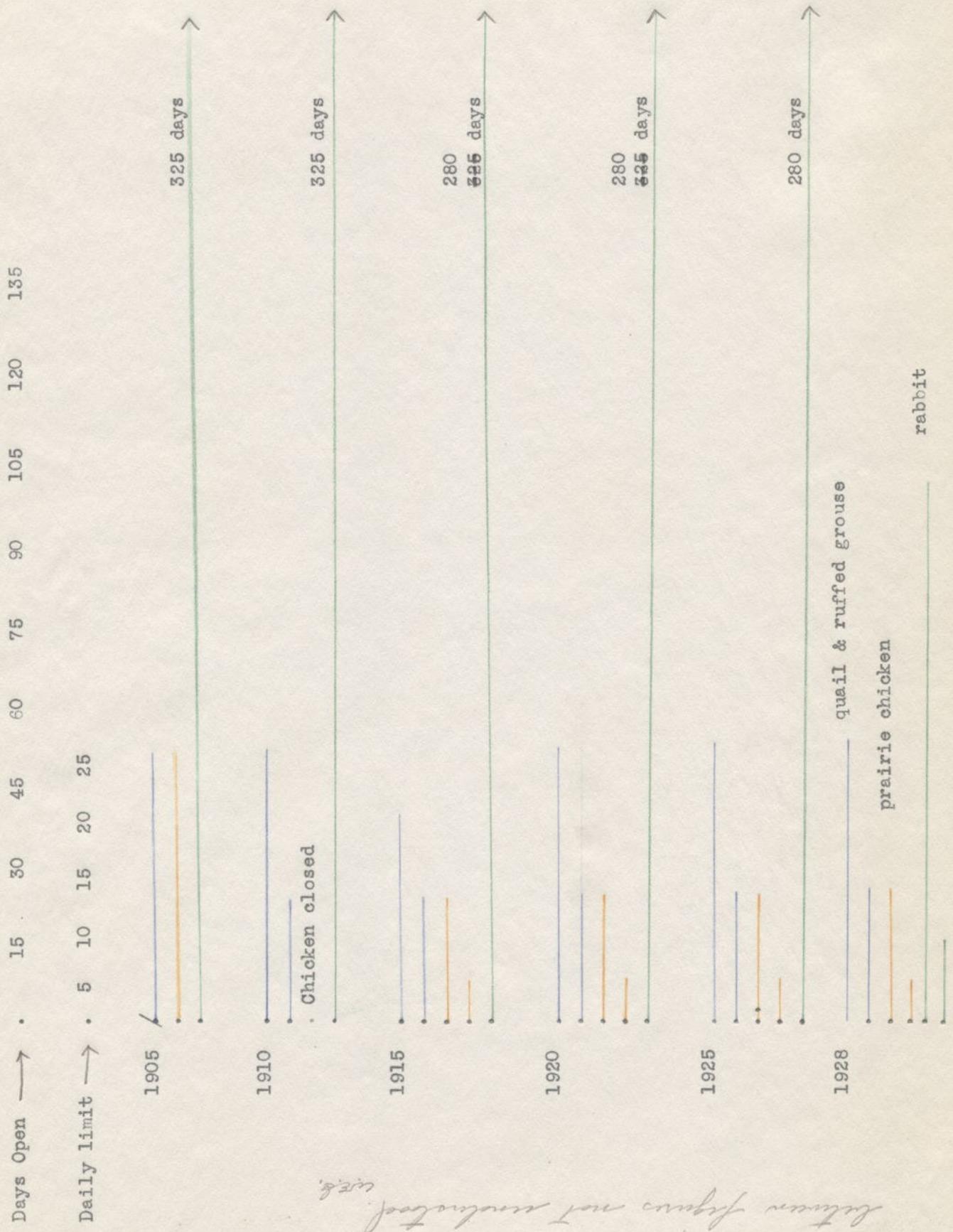
26. History of Open Seasons. Chart T gives seasons and bag limits since 1905.

27. Forestry Program; Forest Tax Law. The forestry division is exceptionally able. Its policies and program can be measured by the same standards as prevail in federal forestry work. This, coupled with a sympathetic attitude toward game, is an extraordinary condition of great importance to the future of both activities.

The present program is:

- (1) Operation of a State Nursery (Clark Co.) and distribution of plantings stock at cost. (Output $2\frac{1}{2}$ million, capacity 5 million trees.)
- (2) Acquisition of 3 trial forests in the southern hill country. (One already acquired. Lands are costing \$9-15 per acre. Some obtained by gift.)
- (3) Administration of the Forest Tax Law to encourage private forestry in woodlots.
- (4) Inauguration of a state fire detection system in the forest regions. (At least 2 towers up. \$15,000 approp. so far refused by Legislature).

CHART T: OPEN SEASONS AND BAG LIMITS UPLAND GAME INDIANA



*Some approximate that from original Prof. S. H. Henshaw's
between figures not mentioned.*

- (5) Research in co-operation with the Ohio Valley Forest Experiment Station at Columbus.

The Forest Tax Law is extraordinarily favorable, and deserves special mention. It was written 7-8 years ago by State Forester Deam, and allows registered forest lands a flat valuation of \$1.00 per acre, against which the current tax rate is applied. There is no yield tax. The owner pays for the Survey (usually about \$10), and must agree not to pasture. The minimum tract is 3 acres. Only 600 tracts totalling 32,000 acres are registered, but this registration must surely increase as the facilities of the law become known.

The law, and its future extension to woodlots generally, is of fundamental importance to game, especially quail, for the obvious reason that each permanent ungrazed woodlot means from 1 to 5 permanent covies. This forest tax law, if widely adopted, holds out more future assurance of perpetuating quail than would a yearlong closure on shooting.

It is likewise of basic importance to ruffed grouse, wild turkey, squirrel, and rabbit.

28. Park Program. There is a growing system of State Parks, all of which are "game preserves," but no attempt was made to appraise their game value, which is necessarily limited except as refuges for turkey and ruffed grouse.

One such park, which was brushy when acquired, was partly sheeped out to provide for public camping, simultaneously acquiring the label of game preserve. The sheeped part of course had lost its game value. This is mentioned simply to illustrate that labels are no criterion of function.

(E) Game Research and Education in Indiana

29. Research Agencies. Purdue University of Lafayette, being the state's centre of agricultural research and education, ought to function as the state's centre for research in game management, but is not yet conscious of this function. The Conservation Department does not lean on the University to do its game work.

The State University at Bloomington has on its staff an ornithologist, Dr. Will Scott, and operates a biological station at Lake Wawasee(?) in Kosciusko County, at which fish research is done for the Conservation Department. No game research (in the strict sense) is yet done by this institution.

There is a Biological Laboratory at DePauw University at Greencastle, but this was not visited for lack of time.

30. Need of a Game Management Text. The Forestry School at Purdue has been anxious to offer its students a general course in fish and game for some years, but has not done so for lack of any existing text on the subject.

Zoology, while foundational to game management, is not game management, just as botany or dendrology is not forestry.

31. Sample Research Projects. The need for fact-finding about game problems is very great. Game is 30 years behind agriculture, and 15 yrs. behind forestry and fish in its foundational facts. In Indiana the work has literally not started yet. Small wonder then that landowners are slow to practice game management. The fewer facts, the greater the risk of failure and the smaller the yield.

The state itself cannot afford to spend close to half a million each year on game with only laymen's opinion as to what to do or how to do it. No other form of applied biology would tolerate the same procedure.

Nearly every section of this report points out some needed piece of game research. To repeat them all in this summary would be duplication. Only a bare list of the most important problems already in sight will be attempted.

1. What kind and location of brush tree and grass cover on the average Indiana farm offers the greatest benefit of quail, insectivorous birds, and erosion control, and the least loss in plough-land or harborage of noxious insects?
2. Given this cover, what methods of winter feeding and predator control produce a maximum quail crop? How much of it can be safely taken? What yields and costs per acre?
3. What is the cause of excess cocks in quail? What is the effect? The remedy?
4. On what Indiana soils can Hungarians be grown in a wild state? Why do they fail elsewhere? What is their response to management? What is the risk of cyclic fluctuation? The cause?
5. On what Indiana soils can ringneck pheasants be grown in a wild state? What are the specifications for a refuge system for pheasants and prairie chickens? What is the relation of pheasants to other game?
6. What modifications of forestry are necessary to produce wild turkeys.
7. What biological specifications should attend the restoration or marshes like the Kankakee? What other marshes, from the standpoint of yield and cost, should be restored by the state?
8. By what methods of refuges or feeding can ducks be restored to Indiana lakes.

9. What fluctuations occur in Indiana rabbits? Why? Is the sex ratio normal? Do males bed out more than females? What is the tularemia risk? Can it be localized by local annual sampling of rabbit populations by public authorities?
10. What damage arises from various populations of foxes in comparison with their recreational value? Why did foxes move north in 1913?

III. APPENDIX.

Appendix A

Persons Consulted
Game Survey of Indiana

<u>Name</u>	<u>Address of Business</u>	<u>City</u>	<u>Capacity</u>
R. F. Wilcox	133 State House	Indianapolis	State Forester
J. J. Kaylor	133 State House	Indianapolis	Asst. St. Forester
Col. Richard Lieber	State House	Indianapolis	Dir. of Conserv.
Geo N. Mannfeld	State House	Indianapolis	Chief, Fish & Game Division
Frank N. Wallace	State House	Indianapolis	State Entomologist
Paul F. Simpson	State House	Indianapolis	Asst. State Geologist
C. W. Guernsey	Clarke Forest	Henryville	In charge State Nursery
Elrod		Henryville	Coon hunter
Dietrich	Garage	Henryville	Sportsman
D. A. Dunlevy		Henryville	Sportsman
C. O. Yost	State House	Indianapolis	Asst. State Entomologist
H. J. Furnish		Scottsburg	Sportsman
Chas. Biederwolf	219 State House	Indianapolis	Ex-Pres., State I.W.L.S.
Horner Phillips	Fish Market	Seymour	Sportsman
John Vandwalle	% Crosley Radio	Seymour	Sportsman
Wm. H. Settle	Lemeke Bldg.	Indianapolis	Pres. Indiana Farm Bureau
S. E. Perkins, III.	701 Inland B.K. Bldg.	Indianapolis	Ex-Pres. Ind. Audobon Soc.
Calvin Purdue	Security Trust Bldg.	Shelbyville	County Agent
V. O. Keith	Keith Furniture	Shelbyville	Sportsman
Alfred L. Harder	Harder Kennels	Vernon	Sportsman & Dog Trainer
John Greyerson	Harder Kennels	Vernon	Sportsman & Trainer

PERSONS CONSULTED (cont'd)

<u>Name</u>	<u>Address of Business</u>	<u>City</u>	<u>Capacity</u>
F. R. Stull	Hardware	Columbus	Ammunition dealer
H. D. Newsome	RR#10	Columbus	Farmer
Oliver Neal		Nashville	Supt. Brown Co. Game Preserve
Sol Wilkerson		Nashville	County Sheriff
Frank Gentry	RR#5	Nashville	Sportsman
R. E. Lyons	Chemistry Dept., U.I.	Bloomington	Sportsman
F. C. Mathers	" " "	"	"
L. E. Shaw	Bloomington Coal Co.	"	"
E. C. Crowmar		Spencer	Game Warden
John A. Cude		Bruceville	Dog Trainer
Arthur Murray	Fire Dept., City Hall	Sullivan	Sportsman
R. E. Llewellyn	Terre Haute Nat'l. Bank	Terre Haute	Pres. Terre Haute I.W.L.A.
Howard Hancock	Attorney	Rockville	Sportsman
Thomas Anter		Attica	Farmer
Clement Isley		Attica	Sportsman
Burr N. Prentice	Horticulture Bldg.	Lafayette	Prof. of Forestry
J. H. Skinner		Lafayette	Dean of Agri- culture
L. A. Test	Chemistry Dept.	Lafayette	Ornithologist
Fred C. Dobelbower	719 N. Main	Lafayette	Secy. Ind. I.W.L.A.
Frank Burtsfield	Supt. of Schools	Lafayette	Sportsman
Dr. S. B. Sims	214 Ross Bldg.	Frankfort	I.W.L.A.
R. H. Daugherty	Sporting Goods	Frankfort	Sportsman
Ivan Pressler		Tipton	Sportsman
M. L. Neeley	2319 W. 9th	Marion	Game Warden
F. M. Charles		LaFontane	Farmer

PERSONS CONSULTED (cont'd)

<u>Name</u>	<u>Address of Business</u>	<u>City</u>	<u>Capacity</u>
Harry H. Hilgeman	403 Standard Bldg.	Fort Wayne	Ex-Pres. I.W.L.A.
Wm. Weigeman	1011 Edgewater Ave	Fort Wayne	Sportsman
Rodney D. Fleming	Lincoln Highway W.	Fort Wayne	Chief Warden Northern Dist.
John Goodrich	Peoples Guaranty Trust	Winchester	Sportsman
J. D. Arnold	Store	Bluff Point	Merchant
John Decker	Decker & Vaughn, Atty.	Bluffton	Pres. I.W.L.A.
Dr. George Hunt	201 N. 7th St.	Richmond	Sportsman
Chas. L. Baker	1213 N. 13th St.	Richmond	Game Warden
Ralph Tapscott	Ford Garage	Greenville	Sportsman
George Cass	Western Cartridge Co.	Nappanee	Sportsman
Andrew Konya	Sporting Goods Store	South Bend	Sportsman
Don K. Stephenson	Stephenson Underwear	South Bend	I.W.L.A.
George Stephenson	" "	"	Sportsman
H. J. Nietzgar	Janitor, Dunlap School	Dunlap	?
Joe Ruch		Milford	Sportsman
W. H. Berst	Hardware Store	Leesburg	Old Settler
Chas. Mauzy	Sporting Goods	Warsaw	
E. J. Parks	Cement Contractor	Nappanee	Sportsman
E. R. Shinn	Postmaster	Mentone	Sportsman
Thomas Hoover	Hotel	Rochester	Sportsman
Fred Ruh	Druggist	Rochester	Sportsman
John Allison	?	Rochester	Sportsman
Geo. W. Smith, Jr.		Kewanna	Farmer
Harry Decker	Ford Garage	Winemac	Pres. N. Ind. Field Trials
Don Wright	Wright Fine Kennels	Rensselaer	Dog trainer

PERSONS CONSULTED (cont'd)

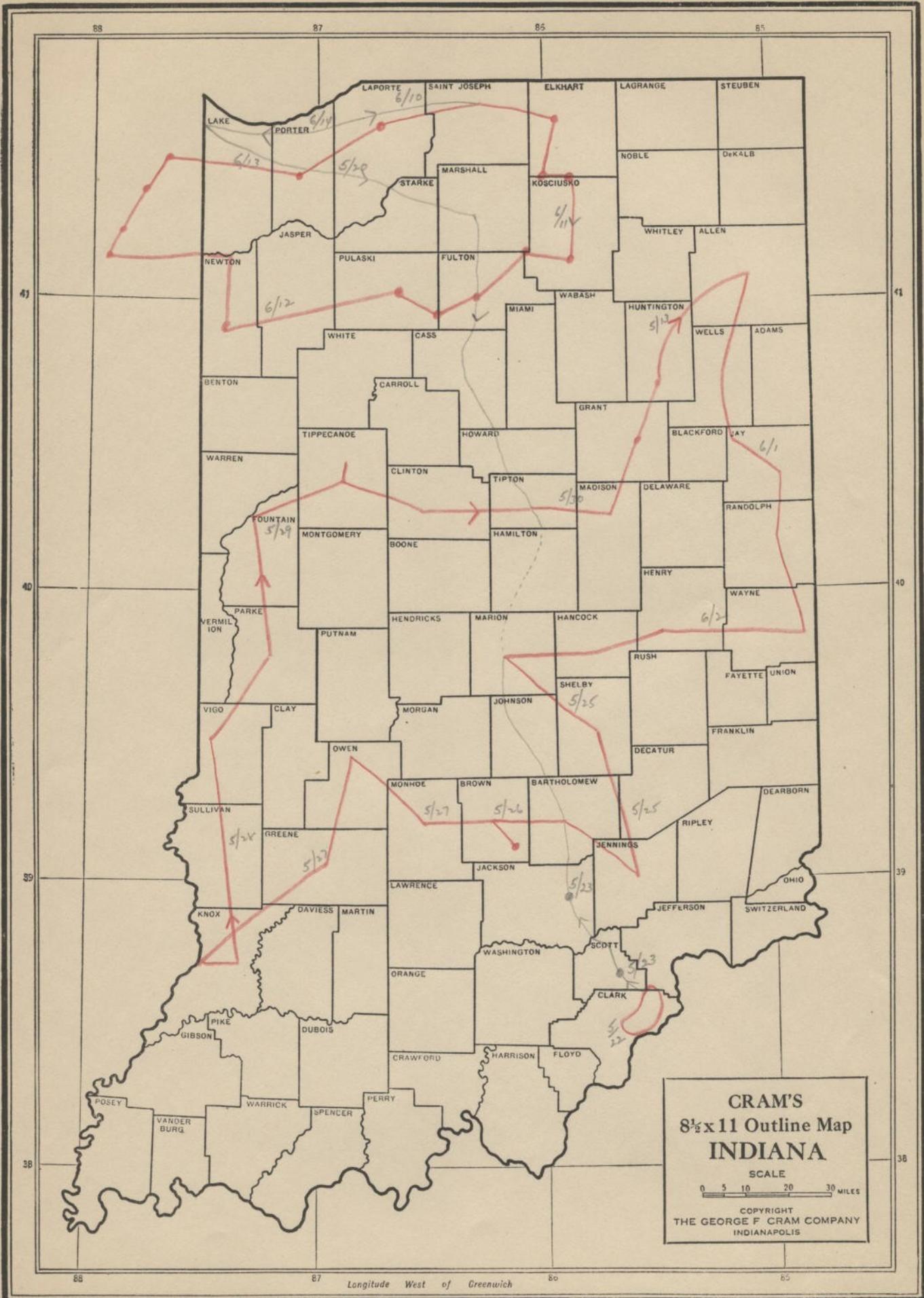
<u>Name</u>	<u>Address of Business</u>	<u>City</u>	<u>Capacity</u>
Ray Smith	Wright Fine Kennels	Rensselaer	Dog Trainer
Harry H. Wheeler	Attorney	Kankakee, Ill.	Sportsman
Z. Buckler		Kankakee, Ill.	I.W.L.A.
Chris Trefa	Kappmeyers Cigar Store	Chicago Heights Ill.	Sportsman
Paul Conrad	Hardware	Pectone, Ill.	Sportsman
G. T. Stanzel	Police Dept.	Valparaiso	Sportsman
Dr. H. O. Seipel	Physician	Valparaiso	Pres. I.W.L.A.
Peter Bozarth	Attorney	Valparaiso	Sportsman
Dr. E. H. Powell	Physician	Valparaiso	Sportsman
C. U. Shields	Attorney, Andrews Bldg.	LaPorte	Sportsman
Elmer Jamison	101 E. Lincoln Ave.	LaPorte	Sportsman

Appendix B

PERSONS MISSED
Game Survey of Indiana

<u>Name</u>	<u>Address of Business</u>	<u>City</u>	<u>Capacity</u>
J. T. Hymer	Remington Cash Register	Indianapolis	
Otto Fifield	State House	"	Secy. of State
Jesse Newsome	Route 10	Columbus	Master of State Grange
C. E. Dixon		Bloomfield	Game Warden
C. E. Pierson	Pierson Lbr. Co.	Terre Haute	Sportsman
Charles Wilding	Tri-State Bldg.	Fort Wayne	Conservationist
Charles C. Dean		Bluffton	Ex-State Forester
Hal Coffel	Bank	Pennville	Naturalist
Ivar Hennings	South Bend Bait Co.	South Bend	I.W.L.A.
Dr. P. R. Bidgett	Physician	Kankakee, Ill.	Pres. Ill. I.W.L.A.

Map of Routes Traveled



* Woodland & Wasteland in South Lancashire

Land Limited Only for Forestry as of 1925
 Woodland & Wasteland
 Wasteland
 Not in Farms

Total No. Farms in 1925	Total Area in Farms 1925	Less in Farm Area 1910-1925	Native Woodland in Farms	Waste Land in Farms	Acres	Acres	Acres	% of Enclosed	
Clay	23,040	2,539	202,483	9,978	26,350	2,030	23,957	52,337	22.3
Alphons	27,720	2,550	242,237	11,125	18,694	17,679	31,083	67,456	24.7
Althwaite	27,280	2,158	253,584	8,992	53,012	19,639	14,896	87,547	32
Ekborn	31,040	2,394	246,277	26,825	15,694	1,409	60,268	77,366	25
Greene	34,520	3,266	286,220	28,853	45,921	2,525	56,100	104,546	30
Trout	32,640	2,367	284,961	24,126	22,964	8,402	34,239	65,605	20
Martin	21,696	1,569	181,765	13,112	52,686	4,680	32,045	89,411	41.2
Owen	25,520	1,683	194,440	36,522	65,854		52,320	118,181	47
Farber	28,080	2,129	240,646	15,746	72,298	2,588	38,984	113,870	39.8
Pike	21,632	2,029	161,990	32,733	14,513	7,461	48,980	70,954	32.8
Pooley	25,280	2,041	221,742	17,092	14,922	3,221	30,538	45,681	19
Putnam	30,920	2,412	263,962	28,437	72,772	2,342	38,958	114,072	37
Spence	25,920	2,267	207,660	28,939	22,731	13,296	46,460	82,487	32
Sullivan	24,400	2,905	237,409	17,600	24,254		51,791	76,045	26
Thundersburg	14,920	1,598	116,356	16,292	8,298	2,921	25,264	36,483	24.5
Thrummillon	162,560	994	130,005	19,253	19,606	2,717	28,955	51,278	31.5
Thyng	261,760	2,428	185,783	44,793	24,080		63,977	88,057	33.7
Warrick	250,880	2,380	210,535	24,699	14,649	15,013	35,345	65,007	25.9
Totals	4,674,320	39,709	3,868,055	405,167	579,298	105,923	714,160	1,409,386	

Note: 1- For wasteland in farms - Deduct from Census Item "All other land in Farms" Acres for each farm for area occupied by house, barn, garden, cattle lot & other improvements.

" 2- For Woodland Not in Farms - Deduct from "Total Area Not in Farm" appropriate acreage for areas occupied by cities, towns & villages & areas occupied by R.R. & Highway rights - Y-entry.

* Compiled by Conservation Dept.

Wild Bird Rest, Inc.

Redfield, Cass County, Mich.

PURPOSE--Wild Bird Rest was organized to promote conservation and propagation of wild animals, birds, trees, plants, fish and flowers native to this district, and to teach the higher ideals in sportsmanship and the necessity of saving the great outdoors before it is too late. Wild Bird Rest is incorporated under the state laws of Michigan on a non-profitable basis, and is promoted and fostered under the auspices of the St. Joseph Valley Chapters of the Izaak Walton League of America. It is chartered for thirty years and permits a total expenditure of \$50,000.00. Stock is issued at the small amount of \$10.00 per share to interest as many people as possible with the conservation idea.

LOCATION--Eighteen miles northeast of South Bend, six miles south of Cassopolis, on the Cass-Elkhart road, at the village of Redfield, Michigan, and is adjacent to Painter, June, Christian, Eagle, Diamond and all of the 170 lakes in Cass County.

ACREAGE--Wild Bird Rest owns 107 acres and holds 200 acres under option and lease. Eleven acres are under water, the ponds covering three times the area of those maintained by Jack Miller, nationally known author, and protector of wild bird life.

AGE--This Bird Refuge was started in February, 1925, and is now ready to blossom into one of the interesting sights of this locality.

DEVELOPMENT--Thus far the low land has been dammed and eight ponds created, forming approximately eleven acres of water thoroughly covered with small brush and trees, giving ideal protection to water birds. Also 1,200 white pine trees have been planted. Three resident tenants farm and police the property.

RESULTS--In the fall of 1926, during the hunting season, as many as five hundred wild Mallards and one hundred twenty-five Wood-ducks were roosting and feeding at a time. They ate three bushels of corn in twenty four hours. From September until the freeze-up in the latter part of November, an average of one hundred twenty-five ducks were using the ponds daily. As many as eighty seven wild Canadian Geese spent three weeks at Wild Bird Rest. Frequently smaller flocks of geese, in their migrating season, visited the ponds. Mallards, Teal, Wood-ducks, Spoon-bills, Coots, Heron, Bluebills, Quail, Pheasant, Muskrats, Coon, Canadian Geese and thousands of frogs are all accepting this hospitality. Last spring, wild Mallards and Teal nested and hatched on the premises, and in fact all but four of the types of birds pictured on this page have already been seen on the farm.

LICENSE--Permits are held from the United States Department of Agriculture, Bureau of Biological Survey, for capturing migratory birds for scientific banding purposes.

QUESTION--Don't you want to line up with this organization and restore just a wee bit of the great out-of-doors? Thousands of us have taken away and destroyed much of nature's beauty and what have we put back? Wild Bird Rest beckons you and also needs your assistance.

Appendix F

BIBLIOGRAPHY

Time was lacking for a satisfactory review of game literature, particularly ornithological literature. The following sources were consulted.

Books, General

- Cockrum, Co. W. M. "Pioneer History of Indiana." Oakland City Journal Press, 1907. (Digest of Chap. XVII attached).
Page, Richard. "New Ways With Partridges." Field Press, Windsor House, London, 1924. (Digest attached).
Sandburg, Carl. "Abraham Lincoln." Harcourt Brace & Co., N. Y., 1926.

Conservation Department Publications

Annual Reports of the Department of Conservation.

- Lieber, Richard, 1928
" " 1927
" " 1924
" " 1922

Reports of the Division of Fish & Game.

- Mannfeld, Geo. N. 1919 (Digest attached).
Miles, G. W. 1913 " "
Sweeney, Z. T. 1908 " "

Mannfeld, Geo. N. "Laws of Indiana for Fish, Game, Etc." 1927-28.

Wilcox, R. F. "Planting Forest Trees in Indiana." 1927.

University Publications

Mallott, Clyde A. "The Glacial Boundary in Indiana." Ind. Acad. of Science, 1925. Also Map.

Fisher, M. L. "The Washed Lands of Indiana." Purdue Agric. Expt. St. Circ. 90, 1919.

"Indiana Crops and Livestock," Purdue Agric. Expt. Sta., No. 14, 1926, No 15, 1926.

DIGEST
of

"New Ways with Partridges"

by Richard Page

The Field Press, Winsor House, London, 1924.

- P. 14. Costs: Partridge is bird of poor sportsman. Yield of 500 acres can be doubled within 3 years by 10 or 15 pounds a year. (£ 10 = \$48) Costs per 500 birds of partridge, grouse, and pheasant is in ratio 1:6:10. Grouse usually cost a guinea a brace. (\$5.11)
- P. 18. Hand rearing pheasants largely discontinued since the war. Shows most hardihood on shoots where least hand rearing has been done--such as Sir Robert Jardine's shoot at Wamphray and some of the mid Anglisey marshes.
- P. 19. Pheasant nests fortnight before partridge, and does not cover eggs.
Vermin 2 pr. carrion crows will get 90% of the pheasant eggs on 1000 acres.
- P. 21. Mowers: Per unit of population 10 times as many pheasants are killed by mowers as partridges.
- P. 21. Conclusions: 50 pheasant nests is all 1 keeper can care for. 3 birds per nest under good keepers reach the hunting season. (Cumberland). 1/3 of the survivors (hens) must be left over as stock.
- P. 22. Cost of hand rearing pheasants before war was as low as 10 shillings (\$2.43) per head. Min. cost now 16 shillings. (\$3.90)
- P. 23. Pheasants being reared for European market in N. China. In

1928 one steamer went through Suez carrying 3000 metric tons (1-2,000,000 birds) frozen, to Marseilles, London, New York

P. 24. Partridge: On an estate with 100 nests yield can be doubled, the additional birds costing 1 shilling (24.3¢) each. Eastern counties get the biggest yields.

Grass Partridge. Alleges there is a type of bird in the uncultivated parts of Cumberland and Westmoreland that eats no grain and lives on weed and grass seeds, especially common rush. Introducing eggs of this stock on grassy estates has produced "astonishing results."

P. 26. Carrying Capacity. 100 acres of the best land should carry 15 pairs of partridge; of poor land (95% pasture) 5 pairs.

P. 27. Life history of Partridge: Family stays intact until pairing, Jan. 12. Pairs stake out "spheres of influence," old birds demanding more than young. Latter satisfied with 8-10 acres or less. Nesting begins May 1. Partridge hates wind. Nests located to avoid wind and get sun. Hatch June 15-28. Hen may desert nest if frightened off while laying or during first week of incubation.

P. 39. 100 million shells per yr. used in Great Britain. Of these he estimates:

Grouse	10%	
Pheasants	10%	
Misc.	10%	
Rabbits	35%	
Partridge	35%	
	<u>100%</u>	(175,000)

No licenses issued, 1929	73,000
Received for licenses	200,000
Est. proportion for partridge	80%
No. keepers (est.) Engl., Scotl, & Wales	10,000
Wages at 2 p. per week	1,000,000

Est. proportion for partridge

35%

Game Rental:

Arable land

1 shilling per acre (24¢)

Woods

1/2 crown (60¢)

Land classes in Great Britain:

Under plough

14 million acres

Perm. pasture

16 " "

Rough grazing

14 " "

44 " "

Average rental for partridge

6 pence (12¢)

Amt.

875,000 pounds.

P. 46. Value of game on typical English farm: 400 acres, 250 arable, rest grass.

Shooting rental

24 pounds per year (\$116)

Census: 20 coveys Partridge, 10 Pheasant.

Rent capitalized

300 pounds (\$1450)

(Above game can be doubled).

P. 48. Samples of crop contents:

1 partridge, March

261 larvae of crane fly.

1 pheasant

1200 grubs

1 pheasant: 726 grubs, 1 acorn, 1 snail, 9 berries, 3 grains wheat.

P. 52. Vermin shift location in March. Work done then will last till winter.

P. 54. Male cats more liable to "go wild" than female. See also Jack Wilson, Marengo, Ill. Wild cats den in haymows, caving creek banks, rabbit holes.

P. 57. Actual case of a cat ferretted out of a rabbit hole in winter.

P. 61. Pheasant "territory": 2 pure Mongolian cocks drove off all the native cocks and appropriated "all the hen birds within radius of half a mile."

Vermin list:

Cat, crow, sparrow, hawk--kill all.

Kestral--kill only killers. Useful on rats and mice.

Rook--all bad on eggs.

Brown owl--bad.

Barn owl--harmless

Rat, skunk, weasel--all bad.

P. 65. Rat never found far from water. Hedgehog bad. Doesn't eat eggs, but rolls them out of nest.

P. 75. Roosts: Partridges roosts on grass land till late fall, when they often roost on clover stubble.

Inbreeding

P. 77. "The prevention of inbreeding is by far the most important point of partridge preservation."

P Example: 1000 acres of isolated range blocked off by heather hills and ocean, in Cardigan Bay. Formerly could kill 40 partridges any day in Sept. Now exterminated. 1000 acres could yield 200 birds a year. (1 per 3 acres). Nuston System invented 1902. First tried on large scale on Duke Grafton's estate in Suffolk. "Pot eggs" substituted for natural eggs as laid, and natural eggs put in incubation or under hen.

When pipped put back under any partridge which has set at least 2 weeks. (Full period 24 days.) Pot eggs cost 2 shillings per doz. All nests are mapped and dated as found.

Pheasants begin laying April 10, partridge May 9.

Clutches for incubator are made up by mixing and trading eggs, 18-19 each.

Partridge begins feathering nest when next to last egg is laid.

When last egg laid all are left uncovered till night when she begins setting. Takes 24 days, but a close-setting hen or incubator will hatch in 23.

System not needed, as far as inbreeding goes, every year.

- P. 90. Hungarian Stock. Thinks they lay infertile eggs. Cited Canada geese imported from U. S. into Cheshire 60 yrs. ago. Still laying 40% of infertile eggs. High proportion of canary eggs also infertile.
- P. 100 Feeding Hours. In winter all birds are on clover stubble at 9 A.M. and 3 P.M.
- P. 125 Disease. Partridge "does not suffer from any trouble corresponding to grouse disease (strong ylosis).
- P. 126 Weather: "Will survive an almost incredible amount of wet, but a combination of cold wind and everlasting wet long grass is deadly."
- P. 127 Selective Effect or Driving: "It is almost a certainty that, if a covey of birds has flown 200 yards, the old ones will be in front, and this is one of the secrets of the great advantage of driving."

Money Equivalents.

Pound	\$4.86
Guinea	5.11
Shilling	24.5¢
Pence	2¢
Crown	\$1.21 (5 shl.)

Digest of "Pioneer History of Indiana."

W. M. Cockrum Oakland City Journal
1907. Chap. XVII, p.427.

Buffalo. Less numerous in S. part than on Kankakee (because of panthers, which killed "untold numbers"). Used the timbered section of the S. part and ate young cane, which covered the creek bottoms. Last killed 1810.

Elk. Larger than those to S. but smaller than those of Minn. and the Dakotas.

Deer. Fell off after 1840. Before then a hunter could kill 8-10 per day. Wintered on mast and in bluegrass section, eating the green grass under the old.

Bear. Nearly as numerous as deer. Could not raise pigs till 1815 or 20.

Rabbit. "There were very few in Indiana in an early day. --- there are twenty here now (1907) where there was one in 1840."

Antelope. "Inhabited the prairie sections around Terre Haute and in the north and northeastern parts of the state - - where the antelope was killed as late as 1840."

Turkey. "Were in such numbers that in one day's hunt there would be seen many flocks of - - 50 to 75 each. They - - each day would travel many miles, usually in circular form." Food - - sassafras, dogwood, black gum berries.

Prairie Hen. "Was quite common up to 40 years ago in the prairie sections of the state and in the timbered regions for many miles around the prairies, but now there are very few to be seen."

Pigeons. Ate bitter mast of the red or ridge oak, and beechnuts. In many places were roosts used year after year, covering several miles of territory. Two of the largest of these roosts were in Scott and eastern part of Marion counties.

Panther. One killed in Washington Co. in 1930 in a "dagger trap."

Bobcat. "Was very plentiful in all sections of Indiana."

Digest of Report of Commissioner of

Fisheries & Game

1907-8.

(Z.T. Sweeney, Oct. 31, 1908)

- P. 25. Plants. During past year planted "1500 birds with good results" (pheasant, partridge, Bob-white). Quail now becoming impossible to get, therefore in future will use pheasants and Huns. "Former are adapted to hilly, broken, wooded tracts, where there is an abundance of underbrush and sparsely settled communities." Commission has now ordered \$12,000 worth of Huns."
- P. 490 Pinnated Grouse. "With the grain fields came the pinnated grouse, for they are one of the few birds which love a touch of civilization. They accompanied the first settlers across the eastern mountain ranges and occupied the fertile valleys of the Ohio and Illinois; across the Mississippi they trailed the pioneers."
- P. 517. Turkey. Great numbers in Marshall Co. (?) Ill., on E. side of Illinois River, Nov. 1864.
- P. 571. Ringneck Pheasant. "There should be left at least one cock for every 3 hens."
- P. 589. Hungarian Partridge. Weight adult 2 to 2½ pounds (?), spread 18-22," length 12-14".
- P. 590. "The propagation of Hungarian partridge in this country is far past the experimental state, and success is certain if the birds are planted in sufficient quantity."
- P. 590. 610 pairs liberated Kansas, 1907.
530 " " Illinois, 1906.
1,000 " " " 1908.
- P. 604. 2,000 birds (Huns.) plus 2,000 pheasants put out 1908? on leased preserves.

- P. 605. Letters from state as to success with pheasants & Huns., all 1908.
- Clayton Carter - Indiana Forestry Reservation: 22 Huns, 24 pheasants, both raised coveys and doing well.
- James Garrard - Vincennes: 20 pheasants. Raised 50-75 birds.
- W. C. Duncan - Columbus, Brown Co. Game Preserve: 32 pheasants, seen numerous broods, think have 100 pairs.
- Senator Thos. T. More - Greencastle, 16 turned down 4 mi. SE of town. Saw broods, thinks have good success.
- P. 607. Will R. Wood - Lafayette: 18 Huns. turned out along Wildcat. All old and 100 young survive.
- P. 608. Fred R. Liddell - LaPorte: 32 Huns. and 8 pheasants turned down 2 mi. SE LaPorte near swampy lake. Remained within a mile. Think have 150 now.
- H. G. Read- Tipton: 17 pheasants raised 100 young.
- W. A. Guthrie - Indianapolis: 19 Pheasants, 4 broods seen.
- P. 609. Quail Shelter. Advises planting sugar cane.
- P. 1055. Snowy Owls in numbers occurred in winters beginning 1885, 1886, 1889, 1905 (big year).
- P. 1013. Goshawk. Rare, No big flights.

1909-10

(G. W. Miles, 1911)

- P. 54. 700 pheasants planted, "had not done so well as he (Sweeney) hoped they would".
- P. 100. 240 Farmer "preserves" now in effect.
Sweeney liberated 3000 pairs Huns. on 120 preserves by Jan. 1, 1910.
Miles liberated 3000 pairs Huns. on 240 preserved by Jan. 1, 1911.
- P. 103. Descriptions and plats of farmers' preserves with dates and numbers of birds stocked (extracted on map).
- P. 297. "Birds of and Indiana Farm" by Jane L. Hine, Auburn, DeKalb Co. Ruffed grouse bred there, date (?).
Wild turkey, last (?) killed "just about the time Richmond was taken, 1864."

Digest of 1911-12 Report
(G. W. Miles, 1913)

P. 230.

As it now appears the provision in the law (of 1907, requiring 1/3 of resident license receipts to be spent on planting) - - - was an unwise one. - - - a much smaller investment would have been sufficient to test - - - European birds in Indiana - - - \$60,000 was expended - - - now it appears that the effort is to prove a failure.

"Reports from - - - 300 game preserves - - - 2 years ago led me to believe that we were to succeed with - - - Hungarians, as they seemed to be raising broods - - - To these were added 3000 pairs imported from Europe. Since then the numbers - - - have not increased, but have grown less, and indications are they will shortly disappear altogether."

"I have made much effort to discover the cause of the disappearance of these birds (after they have promptly set themselves to the hatching of new broods on being liberated, as they always do) but I have been unable to do so. They - - - make no effort to protect themselves against hawks, but on preserves where hawks are not plentiful they succeed no better than where hawks abound. Foxes, too, prey on them but in - - - northern Indiana where there are no foxes -- they disappear as they do in the southern counties. - - - in some preserves they were fed - - - through our last severe winter, only to disappear during the summer that followed."

"300 letters sent out recently - - - indicate that the birds are not to continue here. - - - Hord & Adams, Shelbyville, write - - - there are very few remaining this country."

"John S. Benham, Benham, Ripley County: - - they multiplied rapidly - - but seem an easy prey for hawks - - very few - - are to be found."

"J. C. Robbins, Greensburg: I have given up looking for them."

"Prentiss C. Telley, Brazil; just returned from a trip over the ground. In 1911 we located several covies and thought we had a nice start - but they have either left or died. No dead ones were found."

"Richard C. Elliott, Connersville: "there are a few scattering ones still left."

"The legislature 3 years ago changed the law so that the commissioner may now use the fund - - for hatching fish. Since this - the purchase of birds has been stopped."

P. 234. Prairie Chickens in Indiana. 1909 Legislature closed them till 1915. "Very few people then knew that there were any prairie chicken left. There were a few - - in the prairies adjacent to the Kankakee. This department had no knowledge of them elsewhere."

"Strenuous efforts have been made during the past 3 years in regard to these - - . The success - - has been greater than we hoped. From - - the Kankakee the birds have spread - - eastward across the state, one - - having been recently seen - in Allen County. In Kosciusko there are 1000, in Fulton - - twice as many, while Elkhart has nearly as many as Kosciusko - a few in Wabash, a considerable number in Cass, a few in -- Carroll, Clinton, Boone, a larger number in Tippecanoe, a considerable number in St. Joseph, Marshall, while each of - LaPorte, Starke, Pulaski, White, Jasper, Newton, Lake, and Porter, has many thousands. Single farmers in White report flocks of 300. Further south, from birds - - probably from Illinois, I have a report of one farmer in Vermillion who

claims 400 on his farm; Knox Co. has a large number -- ; Vigo and Sullivan -- also have a good many. To the east -- come reports of flocks in Greene, Davies, Pike -- Gibson.

"At least 1/3 of the 92 counties -- now have -- chickens, and there are certainly more than 100,000 in the state.

"-- it will be possible -- to allow -- a short late season."

"The extremely rigorous winter of 1911-12 did no harm to chickens in Indiana, while it greatly decimated our quail. -- in 1911 quail abounded -- particularly in the south half. Then came the severe winter -- this season (1912?) quail are scarce."

Digest of Report of Division of

Fish and Game

(Geo. N. Mannfeld, 1919)

- P. 73. History of Game Laws. First game law was 1857; prohibited killing or trapping deer Jan. 1 - Aug. 1, and set up open seasons for turkey, quail, pheasant, prairie chicken.

Hunting license established 1907, and revenues turned over to commissioner.

Dept. Conservation established 1919, with fish and game as one of 5 divisions. Previous Commissioners: Fletcher 1881, Reed 1885-9, Dennis 1889-93, Kirsch 1893-7, Sweeney 1897-10, Miles 1910-14, Shireman 1915-19.

(Geo. H. Mannfeld, 1922)

- P. 75. Increase of Quail. "Reports received from every quarter of the state - - bear out the statement - - that quail are more plentiful in Indiana than for many years."

(Geo. N. Mannfeld, 1924)

- P. 97. Increase of Quail. "Quail - - have increased greatly in the last four years.

- P. 98. Quail Census. 1,000 blanks sent farmers (thru game wardens) after cold winter of 1923-4. 795 returns received, covering 143,325 acres of farms (180 acres average).

Covies reported -----2,503 (3.1 per farm, 1 per 58 acres)

Farms reporting no quail-----13 (1.6 of total)

" " increase-----594 (68%)

" " no increase-----166 (28%)

" " decrease ----- 35 (4%)

" " Pheasants -----31 (4%)

" " Prairie Chickens -----12 (1.5%)