A SAMPLING PROCEDURE APPLICABLE TO STATE-WIDE HABITAT EVALUATIONS AND WILDLIFE SURVEYS

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Proc. Annu. Conf. Southeast. Assoc. Game & Fish Comm. 4:172-198

A sound experimental design is a prerequisite to any research problem and a state-wide habitat evaluation and wildlife survey should not be considered an exception. Just as such a project needs a sound experimental design, so does the over-all wildlife management program of the Tennessee Game and Fish Commission need to be based on a sound foundation. Such a foundation is a prerequisite to economy and predictability in a state-wide wildlife management program.

The experimental design of Tennessee's state-wide wildlife survey is based on a method of sampling known as "area sampling." This method is a reliable means of obtaining specific information and one upon which full confidence can be placed.

In brief, the method consists of dividing the study area into many small areas of land which contain approximately equal numbers of the population to be interviewed. The total land area for this survey was divided into 50,914 small areas, called sampling units, which contain on the average of five indicated farms. A total of 1000 of these sampling units was selected at random. Heads of farm households, as well as sportsmen dwelling on these selected areas, are to be interviewed personally. Supplementary habitat information is to be obtained by a somewhat similar selection of 2000 acres, each approximately 160 acres, upon which quadrat studies will be made.

The only means of quantitatively evaluating variation is through the use of statistical theory and as "area sampling" is a means of making such appraisals possible, it is of necessity a product of statistical theory.

An attempt will be made in this paper to emphasize the need, use, and application of "area sampling" in the experimental design of state-wide surveys rather than to expound on its statistical basis.

PURPOSES OF STATE-WIDE SURVEYS

The objectives of a state-wide survey should be to obtain reliable and usable information on:

1. The relative densities and potential range of various game species
2. The economic and social aspects of these game species.

Although state-wide wildlife surveys have been conducted by many states, and are considered valuable by many qualified persons, there are still a very few who criticize them. Such criticism generally falls into one or more of the following categories:

1. The value of survey does not justify cost.
2. Sufficient information for making sound management plans is available elsewhere, i.e., from aerial photographs and agricultural statistics plus a short reconnaissance of the area to be managed.

3. The basic data is inaccurate.
4. The excessive length of such studies tends to make the data obsolete by the completion of the study.
5. The data must be used within a short period of time or the survey must be repeated.
6. State-wide surveys have a habit of degenerating into life history studies.
7. Excessive personnel changes on surveys result in questionable data.

A close examination of these criticism discloses that the first five are related to the experimental design while numbers six and seven are a product of the supervision and can be eliminated as they are applicable to any investigation.

The construction of sampling designs by means of scientific sampling principles minimizes these criticisms and makes it possible to evaluate with considerable confidence the reliability of results obtained by these designs. Jessen (1947) states:

> . . . if surveys are unnecessarily costly, it is not because they are surveys but because they are poorly designed surveys. During the past decade considerable progress had been made toward better use of survey resources by the adoption of appropriate sampling and other statistical procedures. By proper design many surveys can be made to give the desired information at far less cost than that of other methods.
>
> As to inaccuracies, there is sufficient evidence available to show that most data obtained by interview contain them. They occur because of poorly constructed questionnaires, unskilled interviewers, and, in agriculture, the farmer's faulty present as well as past knowledge of the details of his farm and its operation. Some progress has been made in detecting the nature and magnitude of these accuracies, and some measures to control them have been put forth. Overall survey accuracy can frequently be substantially increased by employing a good sampling design. By confining the survey to a relatively small sample, it is possible to select and train investigators more adequately, and to deal with other sources of error effectively. It will often be found that the errors which have been introduced by sampling will be more than offset by the consequent reduction of non-sampling errors.

The statement probably will be made, "Why go to all this unnecessary detail when our present methods of obtaining information are suitable?" But are they suitable and is this unnecessary detail? The answers to these questions are ascertained by knowing how well the present methods fulfil the following requirements of an adequate sampling design for use on state-wide surveys:

1. The procedure must be simple enough to be carried to completion and furnish the required information during the alloted amount of time.
2. As compared to alternative designs it should furnish results of the maximum reliability per unit of cost.
3. The reliability of the results must be susceptible to measurement.
4. The design must be adaptable to studies of change.

Present designs used on state-wide wildlife surveys apparently do not fulfil all of these four requirements. These designs are especially deficient in requirement numbers three and four. Reliability refers to the degree of accuracy or confidence inherent in the results and must be susceptible to measurement which is not the case in all known studies.

According to Hansen and Hauser (1945):

> If it is important that results of a specified reliability be obtained, and if there is a fairly heavy loss involved if the wrong action or decision is taken as a consequence of having depended on results that actually turn out to have larger errors than are considered tolerable, then quota sampling [judgment sampling] cannot safely be employed, and area sampling or some other method for which the risk of error can be controlled should be used. On the other hand, if conditions are such that only fairly rough estimates are required from the sample, and important decisions do not hinge on the result, then only a small sample is required or the price to be paid for using a sample whose accuracy can be measured may not be justified.

The reliability of survey results must be known if extensive wildlife management practices are to be based upon these results. This is especially true at this relatively youthful age of the wildlife profession, a period during which we should strive to obtain public confidence. This confidence cannot be obtained if management practices are based on faulty information.

The fact that the research has confidence in his data is not enough, for it is also essential that persons applying the results of the survey have confidence in the data, as well as in the researcher. Such confidence can, in fact, be obtained only when results are accompanied by statements of reliability that are susceptible to measurement.

The Tennessee Game and Fish Commission intends to use its state-wide survey for the following purposes:

1. To obtain reliable information upon which to base current management and research plans
2. To obtain and use information that will foster public confidence
3. To obtain information that will help formulate plans for a sound public relations program
4. To develop a sampling design that will facilitate future sampling
5. To promote good public relations between the Commission and persons contacted during the survey
6. To train personnel.

DESCRIPTION OF MATERIAL COVERED

Tennessee is a state of extreme variation, in wildlife as well as in topography, soil, climate, land use, and people. The knowledge of this variation is essential to a realistic picture of the state's wildlife management problems.

From the waterfowl areas of West Tennessee to the grouse range of East Tennessee a great diversity of types and densities of game populations exists.

Such diversities are related to the eight major physiographic divisions:

1. Mississippi Bottoms
2. Plateau Slope of West Tennessee
3. Western Valley of the Tennessee River
4. Highland Run
5. Central Basin
6. Cumberland Plateau
7. Valley of East Tennessee
8. Unaka Range

Tennessee soils, which are also related to these physiographic regions, consist of residual and transported types. The Mississippi Bottoms, Plateau Slope of West Tennessee, and the Western Valley of the Tennessee River are characterized by transported soils, while the remaining five physiographic regions are characterized by residual soils.

The influences of physical, biological, economic, and social factors developed a land-use pattern in Tennessee characterized by fifteen (Luebke et al. 1947) types of farming areas (Fig. 1).

1. Cotton and Cash Grain
2. Cotton and Livestock
3. Cotton
4. Dark Tobacco, Sweetpotato, and General Farming
5. Cotton, Truck, and General Farming
6. Cotton and General Farming
7. Dark Tobacco
8. Small General Farming, Corn and Hogs
9. Cotton, Small General Farming, some Livestock
10. General Livestock Farming
11. Small General Farming
12. Very Small General and Part-Time Farming
13. General Farming, Cotton, Dairy
14. General Farming
15. Small General Farming

The wildlife survey is to be conducted on a farming-type basis rather than on a county basis in order to increase the efficiency of the sampling design, avoid repetition, and obtain information in a usable form. Certain areas in these strata (farming-types) will be omitted from consideration in the initial study. In general, they consist of game management areas, inviolate refuges and restricted federal areas. These areas are to be omitted as they are under some type of "wildlife" management or are restricted to field personnel as a result of the war emergency. Personal interviews with farmers and rural sportsmen will be made. Habitat evaluations will also be conducted on a farming-type basis.

INFORMATION TO BE COLLECTED

Questionnaires used to obtain information from farmers and sportsmen during personal interviews are attached. On these questionnaires attempts have been made to word questions in such a way as to prevent ambiguity. The introduction of bias by subsequent rewording of questions by interviewers has been considered; therefore, all interviewers are under strict orders to ask questions as worded,

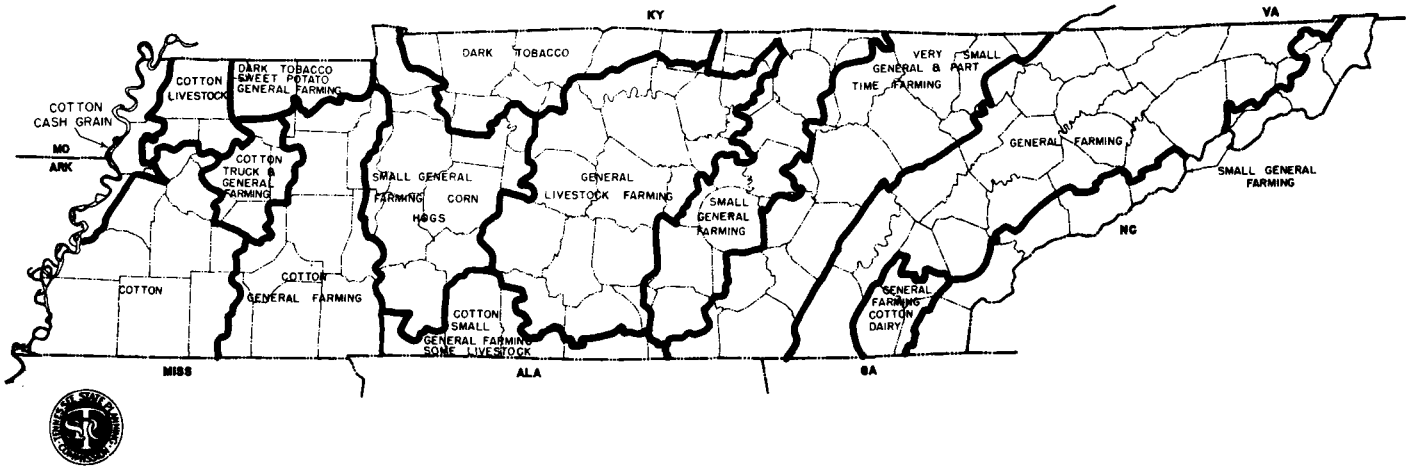

Fig. 1. Types of farming in Tennessee.

although clarification is permissable when necessary. The questionnaires were field-tested and repeatedly revised. It is believed that in their present form these questionnaires will serve the purposes desired in Tennessee. Should additional information be desired, it can be obtained with a minimum of time, effort, and cost when using "area sampling." The unappropriateness and weakness of some questions may be questioned; these in general have been considered, but the reasons for the inclusion of all such questions will not be discussed here. The very weaknesses inherent in them are of value, e.g., knowledge that farmers in certain sections of the state consider Wilson Snipe (Jack Snipe) as synonyomous with Woodcock is of value to the education and law enforcement divisions or our administrative agency.

Every reasonable effort is being made to compare the results of interviews with other sources of information. The object of this is not to obtain information on the sampling error but rather to obtain knowledge of biases, and non-random errors. This is the reason for including questions on crop acreage, even though information on crop acreage is available elsewhere.

SAMPLING DESIGN

Several methods of conducting state-wide game surveys have been utilized by other states in the past. These methods, which will not be described in this paper, contain a basic weakness, that of relying on the judgment of field personnel in evaluating wildlife habitat and populations and making management recommendations. Use of the judgment method usually results in biased samples of the population under consideration. For extremely small samples (2 or 3) use of judgment in sampling generally is sufficient; as sample size increases random samples are better. Samples large enough to be sufficiently stable to provide usable estimates are generally random samples. No single sample represents anything other than itself, i.e., it is not representative. It is only when a group of samples is considered collectively that representativeness is attained (Houseman 1946). The representative tendency of random samples is itself inherent in the method of sampling.

A review of the literature on survey designs and a personal discussion with personnel of the Statistical Laboratory of Iowa State College, resulted in the selection of a method of sampling known as "area sampling" for use on the Tennessee survey project. "Area sampling" is a method of sampling employed by the Bureau of Census and the Bureau of Agricultural Economics.

To reiterate briefly, the method consists of dividing the study are into many small land areas which contain approximately equal numbers of the population to be interviewed. A total of 1000 of these small areas or sampling units was selected at random. These areas were selected by the Iowa State College Statistical Laboratory under the supervision of Daniel G. Horvitz, Research Associate. The sampling instructions furnished are as follows:

> . . . Using information available in the Master Sample materials of the Bureau of Agricultural Economics the total land area for this survey was divided into 50,914 small areas or sampling units containing an average of five indicated farms. Also each sampling unit was constructed to have as close to five indicated farms as

was possible. For this survey, approximately one out of 51 sampling units or a total of 1000 have been selected at random for the sample. Each county is represented by a proportionate number of these area sampling units depending upon the density of indicated number of dwellings (Fig. 2).

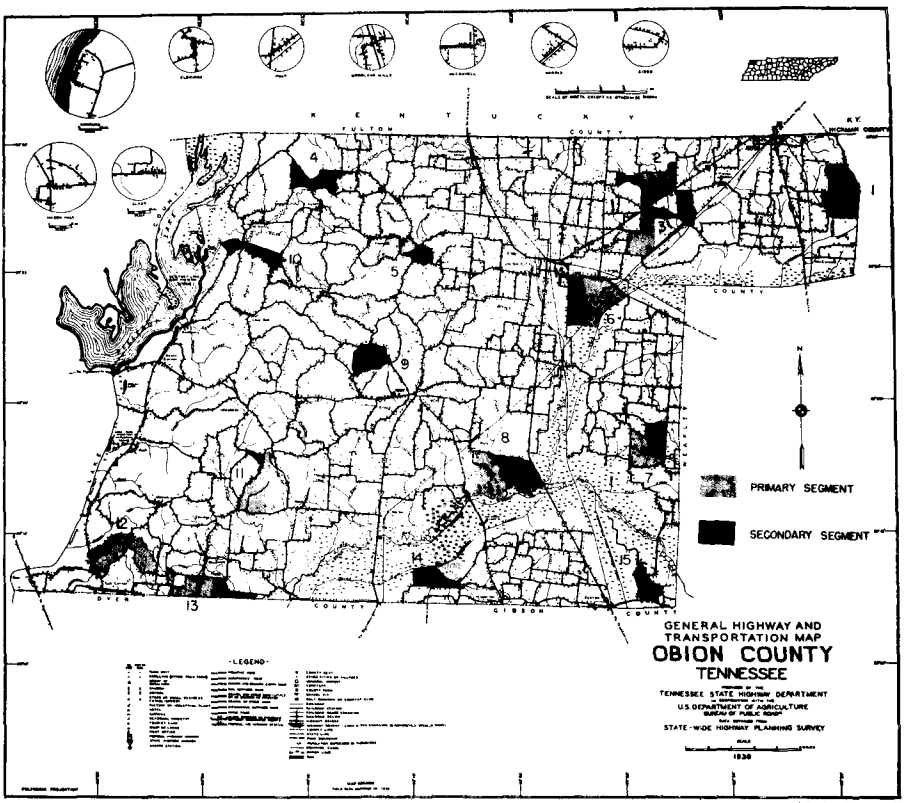

Fig. 2. General highway and transportation map of Obion County, Tennessee.

Each of these 1000 sampling units has been located within a primary sampling unit of average size 10. Each of these primary (red) sampling areas are to be subsampled at the rate of ½. That is, one-half of the eligible heads of households in each red segment are to be interviewed by proceeding systematically through the segment and completing a questionnaire for every other head of household after a random start. It is expected then that an average of five interviews will be completed with those eligible heads of households who live within the boundaries of each red segment. The sample size for heads of households is therefore expected to total 5000.

It is important to note that drawing the sample in this manner every eligible head of household living in the open country zone of Tennessee has an equal chance of being chosen for an interview.

Locating the Segment

The segments have been outlined and colored in red and in green on county highway maps, scale ½" to a mile. The county maps show the location of roads, railroads, streams and rivers, culture (dwelling units, churches, school houses, etc.), township boundaries, villages, towns, and cities. As far as possible, roads and natural boundaries have been used as segment boundaries. In some cases it has been necessary to use Minor Civil Division Boundaries.

The *red segment* may be regarded as the primary segment designated for interviewing. The *green* or secondary segment is to be used only for certain special purposes which will be explained later.

If the culture shown on the maps does not quite agree with what you find in the field or if you find that a stream or some natural boundary indicated on the map no longer exists, *approximate the area colored in on the map as well as you can* by using other landmarks indicated on the map. Culture differences introduce no bias into the sample since every segment and household has an equal chance of being selected, and this chance is based on the number of sampling units, not on the number of map households they were supposed to contain. In nearly all cases there will be some point on or near the segment's map boundaries which you can positively identify. Work from this point, using the map scale and the odometer on your car to approximate the segment boundaries as shown on the map.

Red Segment Identification Table (Appendix 1)

The chief purposes of this table are:

1. To obtain a clear, legible, intelligent record of all dwelling units within the boundaries of the segment.
2. To help determine which of the eligible households are to be interviewed, i.e., are sample households.
3. To provide a convenient record of the action taken with regard to each eligible household in the segment.

One R.S.I. Table should be used for each red segment. Fill in the information asked for at the top of the R.S.I. Table: county, your name, and the segment number.

One line should be used for each dwelling unit located within the boundaries of the red segment. A segment sketch should be used in conjunction with the Red Segment Identification Table on which all dwelling units are located and numbered. Assign the same number to each separate dwelling unit on the R.S.I. Table as you assign to it on the sketch. If you run out of lines, use a blank piece of paper, put the headings for the top of the R.S.I. Table on this sheet, and continue with the listing of the dwellings units, etc. (Enter information as to the number of persons in household who hunted or fished last year.)

List the eligible households in a clockwise manner giving each one an order number along side the name of the head of the house.

The action taken on all eligible households is to be recorded in column 3. When an interview is obtained enter a ("Q") for schedule completed. For eligible households not selected for interview enter ("NQ") for not in sub-sample. If it is necessary to substitute for a sample household ("NQ" under action taken) along with the order number of the eligible household from the red segment used as a substitute.

If the substitute is from the green segment, note this (under action taken). Rules for substitution are given below.

Note that the Red Segment Identification Table need not be filled out completely through (the last column) before any interviews are taken. In fact it is suggested that you interview the sample households as you proceed through the segment in the clockwise direction. Also the information obtained at any one dwelling unit for the R.S.I. Table need not be confined to that dwelling unit only. A person at one dwelling in the segment may be able to give accurate information on the dwellings on either side of his which are in the segment also. However, some check should be made of information obtained in this manner as you proceed through the segment.

Again, you should be very careful to account for all eligible households in the red segment. Every time you overlook two eligible households, you will have, in making estimates for households in the state of Tennessee, thrown away 51 households in the state, since the rate of sampling the clusters of sample households in this survey is one out of 51. If much of this happens, the error attached to the sample will be large and the survey results will be less valuable.

Subsampling:

To determine which of the eligible households to interview, first locate on the sheet provided the random start number appropriate

to the number of the segment you are working in. Then take as sample households the eligible households with order numbers 1, 3, 5, etc. or 2, 4, 6, etc. depending on whether the random start number is a 1 or a 2. You will always interview every other eligible household beginning with the random start number. Encircle the order numbers in Col. 1 of the R.S.I. Table of the eligible households which are also sample households according to the subsampling. (Separate column used on this survey.)

Substitution:

Rather liberal allowances have been made for substitution. If for some reason a sample household cannot be interviewed a substitute should be taken from another eligible household inside the red area which is not a sample household. If the source of substitutes among the eligible households in the red segment is exhausted, you may obtain any additional substitute interviews required from the green segment. You are to enter the green segment only in a certain manner.

a. If the common boundary line between the red and the green segment runs generally *north* to *south,* your starting point in the green segment will be the *north end* of this boundary line.
b. If the common boundary line runs more *east* and *west,* your starting point in the green segment will be at the *east end* of the line.

Once the starting point has been determined, draw in the outline of the green segment *in green* on the segment sketch and show with an arrow your new starting point. Number the dwelling units on both the segment sketch and on a new identification table in a clockwise manner as you go around the segment. You will proceed around the green segment only until you have found enough eligible households to fill out the total number of substitute interviews required.

Substitutes are to be found only within the sampling area. If you exhaust the eligible households in both the red and green segment before you have completed the necessary number of substitute interviews, you may consider the interviewing in the particular sampling area as completed.

What Does This Sample Represent. A note to the interviewer:

You may find yourself thinking as you go to the households in your part of the sample, or as you make substitutions, "Why, these households are not at all typical of this county." Remember, then how the sample is chosen. Your part of it is not intended to be just like the ones they are substituted for. We are working

> with a very small sample which will represent Tennessee households *as a whole* in the open country zone. If households that seem average are not in your part of the sample remember that they will be included in someone else's part.

As a result of including on the Red Segment Identification Table the number of persons who hunted or fished last year, it is possible to obtain an unbiased sample of either hunters or fishermen who reside in rural areas. When the Red Segment Identification Table is being completed by the interviewer sportsmen are told the purposes of the survey and also asked whether or not they would return a mailed questionnaire following the hunting season. As yet untested, it is believed that this contact together with a certain number of "reminders" will increase the number of returns of mailed questionnaires. Non-respondents will be contacted or subsampled.

The value of the "area sampling" materials will not necessarily expire upon termination of the project. Subsequent studies can be made at only a fraction of the initial cost and probably greater accuracy with the use of these materials. One important use of "area sampling" is in the study of change through time.

When using this method of sampling, preliminary results can easily be obtained should necessity require them.

An analysis of the cost components of this project is impossible at this time. Initial planning, training, and equipment costs must be pro-rated over a period of time. The cost components of conducting a survey rarely accompany the final report. This information is vital if efficient experimental designs are to be developed and comparisions made between various designs.

The initial planning, field work, compilation and analysis should be under the supervision of a person with some statistical training. The general supervisor, a wildlife biologist, should be advised by trained statisticians. Such technical advice is readily available from several sources. The statistical aspects of the wildlife survey, being conducted in Tennessee, are under the supervision of the Iowa State College Statistical Laboratory. The function of their survey service is to (Anonymous 1950):

> Advise on the development of the sampling scheme, the preparation of the questionnaire, the training of the interviewers, and the supervision of field work, as well as the calculation of the population estimates and the sampling errors, while the computing service may be called upon to edit and code questionnaires, and process this information on the various IBM machines.

CONCLUSIONS

State-wide wildlife surveys need sound experimental designs. Such sampling designs when compared with alternative designs should furnish the desired information at the lowest cost and with the degree of reliability desired. The lack of such designs in past surveys opens them to criticism. "Area sampling," a sampling method discussed in this paper, is applicable to certain aspects of state-wide wildlife surveys.

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APPENDICES

Appendix 1. Red Segment Identification Table.

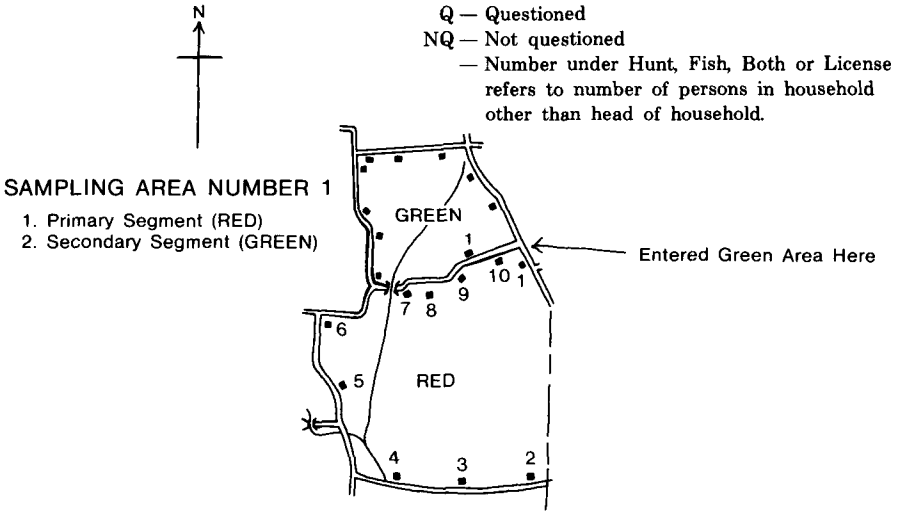
County Obion Interviewer John Doe Segment No. 1

Dwelling Unit Order No.	Farm No.	Name of Head of Household	Hunt	Fish	Both	License	Action Taken	Reasons for Substitutions
1		J. Jones	H	2	1	H		
2	1	S. Smith					Q	
3	2	R. Roach	H				NQ	
4		G. Griffin						
5	3	H. Henry					Q	
6		W. Wilson						
7	4	J. Jack					NQ	
8		A. Anderson						
9	5	H. Hyder	H2	10		1	Gr. Seg. NQ	New Tenant
10		W. Weaver						
1 Gr. Seg.	1	K. Shaffer			H	H	Q	

Appendix 1. Continued

LEGEND

H — Head of household
Q — Questioned
NQ — Not questioned
— Number under Hunt, Fish, Both or License refers to number of persons in household other than head of household.



Appendix 2.

FA 16-2-850
Tenn. Game and Fish Commission
166 8th Ave., North
Nashville 3, Tenn.

RESIDENT QUESTIONNAIRE

County_____ Area No. _____ Aerial Photo No. _____
Enumerator's Resident No. _____ Enumerator_____ Date _____

Race of Resident: _____ White _____ Colored _____ Other
Sex: _____ Male _____ Female Age _____ (years)

1. What is your occupation? _____
2. Do you at present time farm on this area? ____ Yes ____ No
3. What is your status on this area?
   1. Full owner ____
   2. Part owner (rents a portion) ____
   3. Manager (paid salary or wages) ____
   4. Tenant:
      Cash tenant (pays a rental) ____
      Share-cash tenant (part cash & part crop) ____
      Share tenant (share only) ____
      Other ____

   If you are a tenant do you only "rent" cropland? ____ Yes ____ No
4. How many years have you lived on this area? _____ (years)
   In what civil district is this area?_____ Unknown ____

5. How many persons live in this household? _____
6. How many acres do you rent? _____ own?* _____ Total _____

Number of acres in:

1. Pasture ____
2. Orchard ____
3. Woodland ____
4. Fallow ____
5. Crop ____
6. Misc. (residence, water, etc.) ____

Total ____ (check with total given above)

* *Does not include land rented out.*

If none place zero on line.

ASK ONLY APPROPRIATE QUESTIONS

7. What are your crops and how many acres do you have in these crops?

Kind of Crop	Number of Acres	Wildlife Damage To These Crops: (check one for each crop)	Yes	No
_____	_____		____	____
_____	_____		____	____
_____	_____		____	____
_____	_____		____	____
_____	_____		____	____

8. If damage by wildlife, explain type and extent of damage _____

Occasionally in 9 through 14 refers to less than once a year (average).

9. Do *you* burn your pasture? ____ Yes ____ No
   If yes, check season or seasons
   _____ Spring (March, April, May)
   _____ Summer (June, July, August)
   _____ Fall (September, October, November)
   _____ Winter (December, January, February)
   If yes, Yearly _____
   Occasionally _____
   If yes, why? _____
   _____
   Accidental? _____
10. Do *you* burn your orchard? ____ Yes ____ No
    If yes, check season or seasons
    _____ Spring (March, April, May)
    _____ Summer (June, July, August)
    _____ Fall (September, October, November)
    _____ Winter (December, January, February)
    If yes, Yearly _____
    Occasionally _____
    If yes, why? _____
    _____
    Accidental? _____
11. Do *you* burn fallow land? ____ Yes ____ No
    If yes, check season or seasons
    _____ Spring (March, April, May)
    _____ Summer (June, July, August)
    _____ Fall (September, October, November)
    _____ Winter (December, January, February)
    If yes, Yearly _____
    Occasionally _____
    If yes, why? _____
    _____
    Accidental? _____
12. Do *you* burn your crop land? ____ Yes ____ No
    If yes, check season or seasons
    _____ Spring (March, April, May)
    _____ Summer (June, July, August)
    _____ Fall (September, October, November)
    _____ Winter (December, January, February)
    If yes, Yearly _____
    Occasionally _____
    If yes, why? _____
    _____
    Accidental? _____

Appendix 2. Continued

13. Do *you* burn fence rows? ____ Yes ____ No
    If yes, check season or seasons
    _____ Spring (March, April, May)
    _____ Summer (June, July, August)
    _____ Fall (September, October, November)
    _____ Winter (December, January, February)
    If yes, Yearly _____
    Occasionally _____
    If yes, why? _____
    _____
    Accidental? _____

14. Do *you* burn your woodland? ____ Yes ____ No
    If yes, check season or seasons
    _____ Spring (March, April, May)
    _____ Summer (June, July, August)
    _____ Fall (September, October, November)
    _____ Winter (December, January, February)
    If yes, Yearly _____
    Occasionally _____
    If yes, why? _____
    _____
    Accidental? _____

15. Do *you* have horses? ____ Yes ____ No
    cattle? ____ Yes ____ No
    pigs? ____ Yes ____ No
    goats? ____ Yes ____ No
    sheep? ____ Yes ____ No
    If yes, place number of animals on line.

16. Do *you* allow these animals in your woodland?

			If yes, check one:	
Horses	____ Yes	____ No	____ All the time	____ Occasionally
Cattle	____ Yes	____ No	____ All the time	____ Occasionally
Pigs	____ Yes	____ No	____ All the time	____ Occasionally
Goats	____ Yes	____ No	____ All the time	____ Occasionally
Sheep	____ Yes	____ No	____ All the time	____ Occasionally

What season do you pasture your woodland? (designate by placing number of season (or seasons) before name of animal allowed in woodland). Define season before answering.

1. Spring (March, April, May)
2. Summer (June, July, August)
3. Fall (September, October, November)
4. Winter (December, January, February)

____ Horses ____ Goats
____ Cattle ____ Sheep
____ Pigs

17. Have your burned your woodland in the last 5 years? ____ Yes ____ No
    in the last 10 years? ____ Yes ____ No

18. What is the predominate size of trees in your woodland? Define sizes before answering.
    ____ Sawtimber (hardwoods, 13" d.b.h. and over; conifers, 9" d.b.h. and over; cedar, 5" d.b.h. and over)
    ____ Cordwood (hardwood, 5" to 13" d.b.h.; conifers, 5" to 9" d.b.h.)
    ____ Below cordwood (less than above)

19. Number in order of dominance the 4 kinds of trees occurring in the greatest numbers in your woodlot. (Read list before making selection).

____ Sugar Maple (hard)	____ Spruce	____ Cottonwood
____ Red Maple (soft)	____ Oak	____ Hemlock
____ Beech	____ Hickory	____ Elm
____ Birch	____ Yellow Poplar (tulip)	____ Ash
____ Pine	____ Aspen	____ Locust
____ Willow	____ Cypress	

20. Do you hunt? ____ Yes ____ No If yes, ____ > twice/yr.
____ once or twice/yr.
Do you fish? ____ Yes ____ No If yes, ____ > twice/yr.
____ once or twice/yr.
Do you trap? ____ Yes ____ No If yes, ____ > twice/yr.
____ once or twice/yr.

21. Does anyone in this household *other than you* hunt? ____ Yes ____ No
fish? ____ Yes ____ No
trap? ____ Yes ____ No

If yes, list relationship, age, sport, buy license last year, did sport last year and degree of participation (1949 - 50 season).

Relationship	Age	Sport	License last year	Did sport last year	Degree of participation
________	____	______	____ Yes ____ No	____ Yes ____ No	____ > twice/yr. ____ once or twice/yr.
________	____	______	____ Yes ____ No	____ Yes ____ No	____ > twice/yr. ____ once or twice/yr.
________	____	______	____ Yes ____ No	____ Yes ____ No	____ > twice/yr. ____ once or twice/yr.
________	____	______	____ Yes ____ No	____ Yes ____ No	____ > twice/yr. ____ once or twice/yr.
________	____	______	____ Yes ____ No	____ Yes ____ No	____ > twice/yr. ____ once or twice/yr.
________	____	______	____ Yes ____ No	____ Yes ____ No	____ > twice/yr. ____ once or twice/yr.

If persons under 16 years of age fish, hunt or trap do they do so without a license?
Hunt ____ Yes ____ No
Fish ____ Yes ____ No
Trap ____ Yes ____ No

22. Do you have on your property: game? ____ Yes ____ No ____ Unknown
fish? ____ Yes ____ No ____ Unknown
fur-bearers? ____ Yes ____ No ____ Unknown

23. Did you post your land *last year* against:
hunting? ____ Yes ____ No
fishing? ____ Yes ____ No
trapping? ____ Yes ____ No
If against trespassing with no reference to hunting, fishing or trapping check here ____
If posted, when did you first post your land? ________ (year) Why? ______
____

24. Do you allow on your property? If yes, check one:
hunting? ____ Yes ____ No ____ > twice/yr. ____ once or twice/yr.
fishing? ____ Yes ____ No ____ > twice/yr. ____ once or twice/yr.
trapping? ____ Yes ____ No ____ > twice/yr. ____ once or twice/yr.

25. On your property, do you allow *strangers* to If yes, check one:
hunt? ____ Yes ____ No ____ > twice/yr.
____ once or twice/yr.
fish? ____ Yes ____ No ____ > twice/yr.
____ once or twice/yr.
trap? ____ Yes ____ No ____ > twice/yr.
____ once or twice/yr.

Appendix 2. Continued

26. Do you allow hunting of *all* game animals? ____ Yes ____ No
    If no, list the kind that are protected
    _____ _____ If all animals are
    _____ _____ protected, check here __
27. Do you object to hunters hunting without first asking your permission?
    ____ Yes ____ No
28. If you hunt, did you hunt *last year* without a license on land you rent or own? (This is permitted by law). ____ Yes ____ No
29. Do strangers hunt without permission on your property?
    ____ Yes ____ No ____ Unknown If yes, check one: ____ > twice/yr.
    ____ once or twice/yr.
30. Has there been any stocking of game on your property?
    ____ Yes ____ No ____ Unknown
    on this area?
    ____ Yes ____ No ____ Unknown
31. Have your seen on your property
    wild deer? ____ Yes ____ No If yes, how many? ____ what year? ____
    wild turkey? ____ Yes ____ No If yes, how many? ____ what year? ____
    beaver? ____ Yes ____ No If yes, how many? ____ what year? ____
32. Have you seen on *other areas* in Tennessee
    wild deer? ____ Yes ____ No If yes, how many? ____ what year? ____
    wild turkey? ____ Yes ____ No If yes, how many? ____ what year? ____
    beaver? ____ Yes ____ No If yes, how many? ____ what year? ____
    Where? (deer)_____
    Where? (turkey)_____
    Where? (beaver)_____
33. Which of these animals do you think are on your property?

____ Quail (partridge)	____ Opossum	____ Muskrat
____ Rabbit	____ Woodchuck (groundhog)	____ Mink
____ Dove	____ Skunk	____ Beaver
____ Raccoon	____ Crow	____ Otter
____ Waterfowl	____ Ring-Necked Pheasant (Chinese)	____ Woodcock
____ Gray Squirrel	____ Gray Fox	____ Wild Turkey
____ Fox Squirrel	____ Red Fox	____ Bear
____ Grouse (woods pheasant)	____ Wolf	____ Deer

34. How many covies of quail do you have on your property? _____
    Avg. Size _____
35. Is there any game killed *out of season* on your property?
    ____ Yes ____ No ____ Unknown
    on this area? ____ Yes ____ No ____ Unknown
36. Are you interested in increasing game on your farm? ____ Yes ____ No
37. Would you be willing to have a wildlife food patch on your farm?
    ____ Yes ____ No
38. Are there any stray dogs in this vicinity? ____ Yes ____ No

39. What in your opinion has been the change *in this area* (show map) of the number (population trends) of the following animals in the last five years. If you do not know, check in the space provided for this answer. *(Check only for animals found on area.)*

Check if found on area	Do not know	Up	Down	None	Fluctuates
___ Quail (patridge)	___	___	___	___	___
___ Rabbit	___	___	___	___	___
___ Dove	___	___	___	___	___
___ Raccoon	___	___	___	___	___
___ Waterfowl	___	___	___	___	___
___ Gray Squirrel	___	___	___	___	___
___ Fox Squirrel	___	___	___	___	___
___ Grouse (woods pheasant)	___	___	___	___	___
___ Opossum	___	___	___	___	___
___ Woodchuck (groundhog)	___	___	___	___	___
___ Skunk	___	___	___	___	___
___ Crow	___	___	___	___	___
___ Ring-Necked Pheasant (Chinese)	___	___	___	___	___
___ Gray Fox	___	___	___	___	___
___ Red Fox	___	___	___	___	___
___ Wolf	___	___	___	___	___
___ Muskrat	___	___	___	___	___
___ Mink	___	___	___	___	___
___ Beaver	___	___	___	___	___
___ Otter	___	___	___	___	___
___ Woodcock	___	___	___	___	___
___ Wild Turkey	___	___	___	___	___
___ Bear	___	___	___	___	___
___ Deer	___	___	___	___	___

40. If there has been a change in the number of animals in the last 4 or 5 years what do you think is the reason? If no explanation, check here ___.

Name of animal which has changed in number	Reason
___	___
___	___
___	___

41. Have you heard of the *1949 reorganization* of the Tennessee Game and Fish Commission? ___ Yes ___ No

42. What kind of a job is the *new* Game and Fish Commission doing in Tennessee? ___ Do not know ___ Good ___ Average ___ Poor
Comments ___

43. Which of these animals do you think are on this area but not necessarily on your farm?

___ Quail (partridge)	___ Opossum	___ Muskrat
___ Rabbit	___ Woodchuck (groundhog)	___ Mink
___ Dove	___ Skunk	___ Beaver
___ Raccoon	___ Crow	___ Otter
___ Waterfowl	___ Ring-Necked Pheasant (Chinese)	___ Woodcock
___ Gray Squirrel	___ Gray Fox	___ Wild Turkey
___ Fox Squirrel	___ Red Fox	___ Bear
___ Grouse (woods pheasant)	___ Wolf	___ Deer

Appendix 2. Continued

44. Do doves nest on your farm? ____ Yes ____ No ____ Unknown
45. Have you seen in Tennessee any sick or dead doves? ____ Yes ____ No
    If yes, during what month or months? _____
    If yes, in what county or counties? _____
46. Were screw worms *(this year)* present in cattle in this county?
    ____ Yes ____ No ____ Unknown

Reliability _____
(Did you compare questions 33, 39, and 43?) ____

Appendix 3.

FA-16-6-950
Tenn. Game and Fish Commission
166 8th Ave., North
Nashville 3, Tenn.

SPORTSMAN QUESTIONNAIRE

1. What is your age? _____ Date questionnaire is answered _____
   Sex? ____ Male ____ Female Occupation _____
2. In what county are you living? _____
   Do you live in a town or village? ____ Yes ____ No
3. The closest neighboring county is ____ less than one mile
   ____ 1 to 5 miles
   ____ more than 5 miles
4. The name of this neighboring county is _____
5. Do you belong to a sportsman's club connected with hunting or fishing?
   ____ Yes ____ No Name of club _____

(Last season refers to the 1950 - 51 season.)

6. Do you hunt? ____ Yes ____ No
   If yes, did you hunt last season? ____ Yes ____ No
7. Do you fish? ____ Yes ____ No
   If yes, did you fish last season? ____ Yes ____ No If yes, did you fish *last season* using live bait in your home county *without a license?* (This is permitted by law.) ____ Yes ____ No
8. Do you trap? ____ Yes ____ No
   If yes, did you trap last season ____ Yes ____ No
9. Did you last season buy a hunting and fishing license? ____ Yes ____ No
   If yes, did you use it? ____ Yes ____ No
10. Did you last year buy a *hunting, fishing and trapping* license?
    ____ Yes ____ No If yes, did you use it? ____ Yes ____ No
11. Did you last season use a license?
    only to hunt? ____ Yes ____ No
    only to fish? ____ Yes ____ No
    only to trap? ____ Yes ____ No
    to fish and hunt? ____ Yes ____ No
    to fish, hunt and trap? ____ Yes ____ No

12. Number in order of preferences the sports you *do*
Mark only those you do
Use number 1 as first choice ____ Hunting
2 as second choice ____ Fishing
3 as third choice ____ Trapping

13. Did you fish *last season* in a state other than Tennessee?
____ Yes ____ No If yes, in what state did you fish? _____
For what fish? _____

14. Have you heard of the *1949 reorganization* of the Tennessee Game and Fish Commission? ____ Yes ____ No

15. What kind of job is the *new* Game and Fish Commission doing in Tenn.?
____ Do not know ____ Good ____ Average ____ Poor

PERSONS WHO ONLY FISH OR TRAP (OR BOTH) SHOULD NOT FILL IN THE REST OF THE QUESTIONNAIRE

16. Check the hunting seasons you have hunted:

____ 1944-45	____ 1947-48
____ 1945-46	____ 1948-49
____ 1946-47	____ 1949-50
	____ 1950-51

17. Did you hunt *last season* in a state other than Tennessee?
____ Yes ____ No If yes, in what state did you hunt?_____
What game did you hunt? _____

18. How many acres do you rent or own that are hunted?
____ less than 1 acre
____ 1 to 5 acres
____ over 5 acres

19. Check the hunting season you bought a federal duck stamp.
____ 1948-1949
____ 1949-1950 If none of these seasons, check here ____.
____ 1950-1951

20. How old were you when you first started to hunt? _____

21. Check the hunting seasons you were stopped in Tennessee by a conservation officer (game warden)
____ 1948-49 If you have *never* in your Tennesse hunting
____ 1949-50 experience been stopped, check here ____.
____ 1950-51
____ None of these 3 seasons

22. Check the animals you hunted *last season* in Tennessee.

____ Quail (partridge)	____ Grouse (woods pheasant)
____ Rabbit	____ Opossum
____ Dove	____ Woodchuck (groundhog)
____ Raccoon	____ Skunk
____ Waterfowl	____ Crow
____ Gray Squirrel	____ Ring-Necked Pheasant (Chinese
____ Fox Squirrel	____ Gray Fox
____ Red Fox	____ Others, What? _____

23. If you hunted *last season* any of the animals on the following list, in what county (or counties) did you hunt them and what type of country (cover) did you hunt?

Example: Rabbit — Davidson County — brushy pastures and on hill sides
Squirrel — Davidson County — chestnut oak ridges

Kind	County	Type of Cover
Quail (partridge)		
Rabbit		
Dove		
Raccoon		
Waterfowl		
Gray Squirrel		
Fox Squirrel		
Grouse (woods pheasant)		
Opossum		
Woodchuck (groundhog)		
Skunk		
Crow		
Ring-Necked Phesant (Chinese)		
Fox		

Others (name) ..... _____ _____

_____ _____

_____ _____

24. ANSWER ONLY FOR THE ANIMALS YOU HUNTED LAST SEASON

a. Quail (partridge)

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on

____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

b. Rabbit

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on

____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

c. Dove

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on

____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt

____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

d. Raccoon

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on
____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

e. Waterfowl

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on
____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

f. Gray Squirrel

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on
____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

g. Fox Squirrel

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on

____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

h. Grouse (woods pheasant)

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on

____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

i. Opossum

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on

____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

j. Fox

Total number of days hunted..... _____ *Please do not*
Number knocked down and not found..... _____ *leave blank.*
Number killed and found..... _____ *If none, place*
Number of those killed that were given away _____ *zero on line.*

Types of Areas hunted on

____ Federal lands
____ Commercial hunting club
____ Private hunting club
____ State game management area
____ Private land: *If you checked private land, check below*
____ did not ask the owner for permission to hunt
____ with owner's consent, no charge
____ with owner's consent, with charge
____ Don't know type of area

25. List the three animals you hunt in order of preference:

Quail (partridge)	Grouse (woods pheasant)	Fox
Rabbit	Opossum	Woodcock
Dove	Woodchuck (groundhog)	Wild Turkey
Raccoon	Skunk	Bear
Waterfowl	Crow	Deer
Squirrel	Ring-Necked Pheasant (Chinese)	Others (state kind)

Place name of animal on line

1. _____ (first choice)
2. _____ (second choice)
3. _____ (third choice)

26. What in your opinion has been the change in the number (population trends) of the following animals in *this county* in the last five years. *If you do not know, check in the space provided for this answer.*

	Do not know	Up	Down	None	Fluctuates
Quail (patridge)					
Rabbit					
Dove					
Raccoon					
Waterfowl					
Gray Squirrel					
Fox Squirrel					
Grouse (woods pheasant)					
Opossum					
Woodchuck (groundhog)					
Skunk					
Crow					
Ring-Necked Pheasant (Chinese)					
Gray Fox					
Red Fox					
Wolf					
Muskrat					
Mink					
Beaver					
Otter					

Woodcock	_____	___	___	___	_____
Wild Turkey	_____	___	___	___	_____
Bear	_____	___	___	___	_____
Deer	_____	___	___	___	_____

27. If there has been a change in the number of animals in the last 4 or 5 years what do you think is the reason? If no explanation, check here ____.

Name of animal which has changed in numbers	Reason
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

28. Place a check before the name of the animals found *in this county.*

___ Quail (partridge)	___ Opossum	___ Muskrat
___ Rabbit	___ Woodchuck (groundhog)	___ Mink
___ Dove	___ Skunk	___ Beaver
___ Raccoon	___ Crow	___ Otter
___ Waterfowl	___ Ring-Necked Pheasant (Chinese)	___ Woodcock
___ Gray Squirrel	___ Gray Fox	___ Wild Turkey
___ Fox Squirrel	___ Red Fox	___ Bear
___ Grouse (woods pheasant)	___ Wolf	___ Deer

29. Has there been a shift (change) in the location of game populations *in this county* during the last 4 - 5 years? Do not know ____ Yes ____ No
If yes, list animals that have shifted:

_____
_____
_____
_____
_____

30. If there has been a shift in the location, what do you think is the reason for this shift? If no explanation, check here ____.

Animal	Reason
_____	_____
_____	_____
_____	_____
_____	_____

31. What suggestions do you have for the increase of game or furbearers in your county? (State animal and suggestions). If none, check here ____.

_____
_____
_____

32. What do you think of the various bag limits, seasons and other regulations pertaining to hunting? If they are satisfactory, check here ____.

_____
_____

33. Have you seen in Tennessee
    Wild deer? ____ Yes ____ No
    If yes, where? _____ when? _____
    Wild turkey? ____ Yes ____ No
    If yes, where? _____ when? _____
    Beaver? ____ Yes ____ No
    If yes, where? _____ when? _____
34. Are you satisfied with the hunting conditions in Tennessee?
    ____ Yes ____ No If no, why not? _____
    _____
    _____
35. Have you seen in Tennesse any sick or dead doves? ____ Yes ____ No
    If yes, during what month or months? _____
    _____
    _____
    If yes in what county or counties? _____
    _____
    _____