

RESEARCH REPORT ON
FOUR STATE MULTIPLE FRAME STUDY
MARCH 1966 TO JUNE 1968

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FOUR STATE MULTIPLE FRAME STUDY

The study was conducted in Illinois, New Mexico, Oklahoma, and Tennessee during the period from March, 1966 to June, 1968. The purpose was to explore the feasibility and problems involved in using lists of livestock and poultry producers with an area sample in multiple frame sampling. The study was undertaken jointly by the Research and Development Branch of the Standards and Research Division and the Illinois, New Mexico, Oklahoma, and Tennessee State Statistical Offices of the Statistical Reporting Service, USDA.

1. Objectives

Objectives of the project were: (1) to gain insight into problems associated with proper identification of the sampling units in different frames, (2) to investigate data collection using less costly means (mail and telephone), (3) to study the use of different kinds of sampling units in the various frames and (4) to develop ways of determining the portion of the area frame overlapped by the list.

The phases of the study were: (1) to locate list sources and to determine how the lists were compiled, the type of units listed, the degree of coverage, amount and kind of control data contained in the list, and whether or not the list was available to SRS, (2) to obtain lists that were available for cattle, sheep, and poultry, (3) to experiment or develop ways for using available lists for cattle, sheep, and poultry, and (4) to establish procedures for maintaining the lists.

2. Summary of Project Results

The major results and conclusions are stated briefly in this section. Detailed results are given in the remainder of this report.

- a. The best lists for cattle surveys were the Illinois State Farm Census, the Tennessee ASCS list, and the Oklahoma Tax Assessments list and the New Mexico Tax Assessments list. The best lists for sheep and chicken surveys, respectively, were the ASCS Wool Filings list and the SRS Commercial Layers list.
- b. Obtaining lists of cattle farmers from county tax rolls is costly. Individual tax records in loose leaf form can be microfilmed for about \$2.50 per hundred names. It costs from \$4.50 to \$8.00 per hundred names to copy records from bound books by hand or with a copying machine.

- c. Converting lists to punched card form is another significant cost, amounting to \$6.50 to \$8.00 per hundred names. Large lists must be kept on machine media to obtain the sorting capability needed for stratifying, drawing samples, updating and printing.
- d. The lists used were suitable for multiple frame sampling, but not complete enough for single frame sampling. Farms on the lists had larger than the average inventories of cattle, sheep, and chickens.
- e. Mail and telephone data collection techniques effectively reduced the survey costs as compared to personal interview surveys. At least two-thirds of the mailed survey non-respondents can be interviewed by telephone. Data collected by mail and by interview were equally accurate, based on small quality check surveys.
- f. For a fixed degree of precision -- cattle, sheep, and chicken estimates can be obtained more economically with multiple frame sampling than with only area frame sampling. The screening estimator was the optimum multiple frame estimator in the majority of cases studied.
- g. Slightly more sheep and chickens were reported on the quality check re-enumerations than on the original survey questionnaires. The average differences were generally not statistically significant. The largest individual reported differences were for the number of chickens on the land operated. Reasons for the differences were: another respondent, data estimated once but taken from records the other time, wrong information given first time and respondent failed to associate chickens with land operated.
- h. Attempts to motivate the mail survey respondents to precisely define the reporting units as the total land operated were not entirely successful. The respondents must clearly understand what the survey reporting units are. Special questionnaires and enumerating techniques are needed for operations with complex tenure arrangements, multi-state operations, estate farms, corporation farms and institutional farms.
- i. The landlord and tenant often gave different information about a parcel of land. Their reports of the total acres of land in the parcel differed by more than 10 percent in 85 of 305 cases investigated. These differences occurred more frequently in Tennessee and New Mexico than in Illinois and Oklahoma. The reasons were: (1) many farmers in Tennessee and New Mexico

don't know the total acreage in their farms accurately and (2) in all four states individuals interpret in various ways terms such as rented, leased, managed and partnership.

- j. For flocks of chickens (laying hens) grown under contract, the contractor would be a better data source than the contractee. The reporting unit would be the total chickens a contractor had under contracts. Sampling a list of contractors would result in more accurate data and smaller sampling errors than would be obtained by associating the contract chickens with land where they are located.
- k. Most individuals who listed cattle on the New Mexico tax rolls and lived outside the state actually operated larger than average cattle ranches in the state. Some have local managers. It is feasible to survey operations of this type.
- l. The New Mexico ASCS list contained about 15 percent duplicates within counties and less than one percent between counties. The ASCS lists contain more duplications of people than the tax assessors lists do. The entire tax list was not compared with the ASCS list as we obtained only those persons who listed cattle on the tax rolls. Only 57 percent of those listing cattle on the New Mexico tax rolls were on the New Mexico ASCS list.
- m. The variance of the multiple frame estimator can be reduced by using a more complete list. It is sometimes advisable to merge two different lists for the same year or lists from the same source for two different years.
- n. Nine to 13 percent of the units on ASCS and tax lists are deleted each year; approximately the same number of new units are added. For the units staying on the lists two years in succession, about five percent will require address changes and 12 percent will change from one size group to another (assuming four or five size groups are used).

The field cost for updating is the same as the cost of obtaining the list. However, the cost of keypunching a new list is about three times that of updating a one year old list for changes in names, addresses, and size group codes.

- o. It can be shown that the failure to detect overlap units in the area sample and the failure to detect duplicate units in the list frame both lead to positive bias in the multiple frame estimator. Reasons for not matching cases which should have been matched were: (1) different names, (2) nicknames, (3) some cards not printed, (4) some records out of order, and (5) persons doing the matching missed some. Improved methods of matching names are needed.

3. Investigation of List Sources

3.1 List Sources Contacted in Washington, D.C.

Federal Government Agencies contacted in Washington, D.C. were: Agricultural Stabilization and Conservation Service (ASCS), Federal Crop Insurance (FCIS), Federal Extension Service (FES), Soil Conservation Service (SCS), Rural Electrification Administration (REA), Farmers Home Administration (FHA), Agricultural Research Service (ARS), Forest Service (FS), Internal Revenue Service (IRS), Social Security Administration (SSA), Bureau of Reclamation (BR), and Bureau of Land Management (BLM).

ASCS is compiling a list of participants in farm programs. This list was available on magnetic tape in late 1968 with the following information: name and address, social security number, and total payments received from government programs during 1968. The information on tape will not classify the payee as a farm operator or indicate the type of farm. Since many ASCS payees are not farm operators and many farm operators do not participate in the programs, the lists are incomplete. They may still be useful, of course. The coverage of farm operators by the ASCS list will vary by States and counties. The list will probably be more nearly complete in the South than in other areas. A list with more control information is available in the County ASCS Offices on Farm Record Cards. A base acreage was determined for every eligible farm, but if a farm was not involved in farm programs recently, this information has deteriorated and probably is not highly correlated with present operations.

ARS at one time compiled lists of livestock farmers for disease eradication programs but they found that maintaining these lists was expensive because of the amount of change in the list. However, they continue to inspect all sheep flocks periodically (every three years). Other specie lists have deteriorated and would not be useful.

The Forest Service has a list of National Forest Permittees on tape with adequate control information about livestock numbers. They have fair coverage of sheep and cattle operators in the FS areas. The list of permittees is available to SRS.

Other Federal Agencies contacted in the Department of Agriculture such as FES, SCS, FHA, and REA commented that most farm operators on their lists could also be located in ASCS files. The other lists could add from one to

five percent to the ASCS lists.

The Internal Revenue Service has approximately three million names on tape consisting of people who have filed a Form F reporting farm income. SRS number of farms estimates and the number of Federal Income Tax Returns (Form F) seem to correspond closely, particularly the income distributions. There were about 7 percent fewer Form F's filed than the estimated number of U.S. farms in 1962. However, the differences between the number of farms and the number of tax returns varies by level of farm income (gross), individual States, and Regions. The reasons for most of these differences are: (1) income sharing under landlord-tenant and partnership relationships results in more tax returns than farms, and (2) many farms realize less than \$600 gross income and thus no income tax return is filed.

The information on IRS tapes is not sufficient to identify individuals as farm operators. At the IRS Service Centers, the Form F's are classified by type of farming operation: grain, vegetable, fruit and nut, livestock, and other farms. An unknown number receiving income from farming but not qualifying as farm operators are included.

The Social Security list is smaller than the IRS list and contains few additional names. The SSA list is a list of farm labor employers.

The Bureau of Reclamation list of farms under BR irrigation projects in 17 Western States would be fairly complete. For example, in New Mexico and Texas, their list of farmers who have irrigated cotton is virtually complete. The BLM permittee lists do not cover all livestock operators in the 11 Western States but it is suggested that they be used as a check in evaluating other lists.

SRS has researched compiling new lists and using developed lists for certain crops, labor, and livestock items. For example, the 1953 Mississippi Experimental Cotton Survey, the 1965 Mississippi Multiple Frame Study, and the Wyoming Multiple Frame Livestock Survey. The results were plagued by incomplete lists, duplicated names, sampling units different from reporting units, and difficulty in matching units between lists.

In summary, few lists are maintained in Washington, D.C., but most are maintained by the State and County Governments. Few, if any, lists cover the entire universe of interest.

Two or more lists might be collated to build an adequate list frame for special purpose multiple-frame sampling with the area frame. The ASCS wool producers list and the ARS scabies list could be collated to obtain an adequate list of the sheep producers. The list would cover at least 80 percent of the sheep. Few poultry lists are compiled by Federal Agencies. The SRS commercial layers list is the most promising list. No Federal cattle producers list would be satisfactory except ARS lists in a few States. Many farmers on the ASCS list have cattle but the list contains no information about cattle. ARS, BLM, and other lists are incomplete and out of date.

3.2 List Sources Contacted in the States

Organizations contacted in the States included ARS, C&MS, ASCS, SCS, IRS, State Extension Services, State Sanitary Boards, State Tax Offices, Universities, Livestock Associations, and Publishers of Farm Magazines. Discussions were held regarding the lists coverage of the universe, control data available, location of the lists, extent and frequency of maintenance, and the availability of the lists to SRS.

3.3 Lists Obtained for the Project

The lists which were best suited for cattle, sheep, and chicken surveys were obtained in the Fall of 1966. Sample surveys using these lists were carried out in December 1966 and 1967. The lists obtained varied by species and by States.

List Used in Illinois

The State Farm Census (SFC) was used for all three species (cattle, sheep, and chickens) in Illinois. The SFC names are people who had three or more acres in one operating unit with some agricultural operations, plus places of less than three acres that have a large poultry or cattle feeding operation. Each name is supposedly listed once in the township containing the farm headquarters. The Illinois SFC data are collected from April to June each year. Sampling could begin about January 1. Livestock inventory data are obtained for hens and pullets of laying age, breeding ewes one year and older, and cows (milk and other) two years and older on January 1. Cattle marketed, sows farrowed, and feeder pigs purchased during the past year are also listed. Compared with the 1964 U.S. Census, the 1965 SFC listed 105.2 percent as many farms, 81 percent as many cattle farms, 50 percent as many sheep farms and 53 percent as many chicken farms.

Cattle Lists for New Mexico, Oklahoma and Tennessee

Cattle owners from the tax rolls for 10 counties in New Mexico were obtained from the State Assessor's Office in Santa Fe by ARS and SRS. The coverage of the universe varied from county to county but most of the large operators were listed. In addition to the name and address of each cattle owner, the total number of cattle by age and sex was included. Geographic location was not included but could be obtained for future surveys. The cattle owners were listed alphabetically within school districts in each county. Farm operators and other persons are filed together with approximately 40 names per page. A name can be listed more than once if the listee had land in more than one township. There is an index file for each county showing the page number(s) on which each name is listed. This file can be used to help eliminate duplications.

Cattle owners from the tax rolls of four Oklahoma counties were sampled for the December survey. The list was obtained from the tax records in the County Assessor's Offices. The names are persons filing for personal property tax assessment. The filings are regulated by State Statutes plus incentives for filing through the homestead exemption and gasoline tax allowance. County assessors estimate that the list covers 80 to 90 percent of the cattle. The actual coverage is probably 50 to 60 percent. The names are filed alphabetically within school districts. If a person has cattle in more than one school district, his name is listed more than once. The data must be copied by hand or machine since the names, addresses and control data are on individual assessment forms. In some instances, one could contract with someone working in the assessor's office to copy the information. ARS used this list for their brucellosis testing and found it was the best list for locating cattle operators.

The Tennessee Department of Agriculture and the USDA Animal Health Division of ARS gave the Tennessee SSO a list of cattle farmers. County agents in the 18 counties of crop reporting district 4 were visited and asked to examine the list for non-cattle producers. Approximately 10 percent of the names were removed because of deaths, names listed more than once, relocated, farm name and owner both listed, sold out, partnership dissolved, other member of family listed with only one farm, farm flooded by new dam, etc.

In addition to the name and address of each person; the zip code, longitude, latitude, county and the number of cattle were also recorded when the list was obtained. The number of cattle

was omitted on about 30 percent of the records. The size of the omitted cattle operations varied. This list continues to enlarge each year because veterinarians submit a form every time they visit a farm and names are never deleted. As a result, there are approximately 125,000 names on the list while there are only about 100,000 cattle farms in Tennessee.

The Tennessee office also obtained the ASCS list for the entire State. The ASCS farm list was obtained in 1965 in the form of addressograph plate impressions on three by five inch cards. The data included name and address of the owner and the operator, acres in the farm, acres of cropland, and an identification number. Pieces of land which are physically separated are considered to be different farms by ASCS so that one person's farm operation may include several ASCS farms. Thus considerable duplication of farm operators is known to exist in this list. All obvious duplication of operators names in district 4 was eliminated prior to sampling. However, some duplication remained even after a thorough job of screening. In 1967, the ASCS list for the entire state was put on magnetic tape. Three different printouts of the list were made to locate further duplications and to study the updating problems. List updating is discussed in Chapter 6 of this report.

Sheep List for New Mexico, Oklahoma and Tennessee

The 1965 list of participants in the ASCS Wool Incentive Programs was obtained. Some updating was done using the 1966 ASCS wool filings lists. The participants are people who sell wool and file a form with ASCS for wool incentive payments. Some of the participants are not farm operators but raise sheep for FFA or 4-H projects. The number of participants in New Mexico was about 1800 (excluding Indian sheep producers), 1850 in Oklahoma, and 2030 in Tennessee. Control information about size of operation are the number of sheep shorn, weight of wool marketed and cash received for the wool.

Chicken Lists for New Mexico, Oklahoma and Tennessee

The most recent list of SRS commercial egg producers (excluding commercial contractors) was the best available list. It is updated periodically by reviewing names compiled by the Extension Service and others. This list usually excludes farm flocks which represent a small percentage of total hens in each of the States.

In Oklahoma, the SRS commercial list was supplemented with lists of State licensed egg dealers. This list includes both producers and non-producers. No information was available on the list to differentiate between producers and handlers. In 1967 a question about the number of layers was added to the application form to solve this problem. This list is updated annually in July.

In Tennessee, the SRS commercial list was supplemented with a list of commercial egg producers from the Ellington Agricultural Center. This list is compiled annually in connection with the State egg inspection program. The program applies only to those producers who sell their eggs directly to a grocery store. An egg license is not required for those producers who sell their eggs to a handler instead of a store. In this case, only the handler needs the egg license.

In New Mexico, the only known source of names of commercial poultry growers is compiled and maintained by the State Extension Service. This list represents most of the commercial poultry producers. No information is available to evaluate the percent of layers the Extension Service list covers.

4. December 1966 Survey

The objectives of the December 1966 Survey were to gain experience using the lists, to test methods of defining the reporting units, and to check on how accurately land was being reported.

4.1 Sample Design

The lists used in the December survey are shown in Table 4.1.

Table 4.1 - Lists used for December 1966 surveys

State	Livestock Species		
	Cattle	Sheep	Chickens
Illinois	State Farm Census	State Farm Census	State Farm Census
Tennessee	ARS List	ASCS Wool List	SRS Commercial and Ellington Center Lists
Oklahoma	Tax Assessor's List	ASCS Wool List	SRS Commercial and State Licensee Lists
New Mexico	Tax Assessor's List	ASCS Wool List	SRS Commercial and Extension Service Lists

Samples of about 500 names per specie were drawn in each of the states. Persons who were to be contacted during one of the regular SRS surveys were deleted from the list samples. Separate questionnaires (see Appendix E) were designed for the cattle, sheep and chicken samples. Two mailings were made to the samples to maximize the response ratio. No non-response sampling was done since the primary objective was to gain experience sampling the lists and not to make livestock estimates.

4.2 Analysis

4.2.1 Definition of the Reporting Unit

In probability sampling the reporting units must be precisely determined so that the probabilities of selection may be correctly determined. The questionnaires used in the December 1966 survey included a section designed to define the reporting unit. The respondents were asked to list each parcel of land owned or operated and the names and addresses of landlords, tenants, managers, and other second parties. The results shown in Table 4.2 indicate that about 43 percent of those responding by mail (1137 of the 2637 total) did not complete this section satisfactorily. Although the individual questions (see Appendix E) were answered satisfactorily in most cases, many of the respondents did not compute the total acres operated in item 14. Since the specie questions relate to livestock on the land operated, the reported livestock numbers are suspect anytime question 14 was not answered correctly. The implication is that a different method of precisely defining the reporting unit is needed for mailed surveys. The surveys conducted in June 1967 included attempts to simplify the computation of land operated for the respondent.

Table 4.2.--Number of questionnaires with positive entries and number edited, by question, December, 1966

Question Number <u>1/</u>	Illinois		Tennessee		Oklahoma		New Mexico	
	Positive Entry	Edited	Positive Entry	Edited	Positive Entry	Edited	Positive Entry	Edited
2	314	1	629	3	684	26	503	10
4	233	7	123	0	324	20	198	12
6	4	4	7	0	5	2	17	7
8	45	9	132	0	87	14	41	2
10	1	1	4	1	4	5	7	3
12B	33	6	64	10	51	14	37	5
13	8	5	1	1	27	10	20	15
14 <u>2/</u>	516	189	683	416	834	300	604	232
16 <u>2/</u>	516	21	683	85	834	66	604	33

1/ See Appendix E for examples of questionnaires used.

2/ The total number of returns is shown under "Numbers with Positive Entry" for items 14 and 16.

There was concern over the effect a long, detailed questionnaire might have on mailed survey response rates. The response rates shown in Table 4.3 suggest that the length of questionnaire did not reduce respondent cooperation appreciably, if any, since the response rates are higher than for many SRS surveys using much shorter questionnaires. A small percentage of the questionnaires were returned by the Post Office due to addressee unknown and insufficient addresses.

Table 4.3.--Response rates for December, 1966 study

Item	Illinois	Tennessee	Oklahoma	New Mexico
Number mailed, 1st mailing	1,114	1,430	1,512	1,447
Percent response to 2 mailings	46.3	47.8	55.2	41.7
Percent returned by Post Office (Not deliverable)	2.9	2.2	.4	2.3

4.2.2 Tenure Distribution of Respondents

Table 4.4 shows the absolute and relative frequencies of various tenure arrangements by States and the 4 State total. Seventy-two percent of the reports were for operators who owned and/or rented land with no other operating arrangements reported. There are problems in getting the respondents to report partnerships properly. The small number of partnerships reported and the fact that 159 of the 182 partnerships were two man operations were considered encouraging. Many of these operations are informal family arrangements and not legal partnerships.

Table 4.4.--Tenure arrangements by type and by State, December, 1966 study

Tenure Arrangement	Illinois	Tennessee	Oklahoma	New Mexico	4-State Total
	<u>Number</u> <u>Percent</u>	<u>Number</u> <u>Percent</u>	<u>Number</u> <u>Percent</u>	<u>Number</u> <u>Percent</u>	<u>Number</u> <u>Percent</u>
Full-owner-operator	176 34.1	346 50.7	380 45.6	267 44.2	1169 44.3
Renter only	133 25.8	9 1.3	75 9.0	10 1.7	227 8.6
Owns and rents	106 20.5	76 11.1	177 21.2	153 25.3	512 19.4
Partnership	34 6.6	60 8.8	51 6.1	37 6.1	182 6.9
Not a farm operator	24 4.7	37 5.4	62 7.4	78 12.9	201 7.6
All others	43 8.3	155 22.7	89 10.7	59 9.8	346 13.1
Total	516 100.0	683 100.00	834 100.0	604 100.0	2637 100.0

Of the operations which were out of business at the time of the survey, most of them did exist when the lists were compiled. Persons reporting cattle, sheep, or chickens but operating no land were edited to zero since the reporting unit was defined as the livestock or poultry on the land operated. These reports were for 4-H or FFA projects, retired people living in the farm house, and people having hired managers to operate their farms. About 8 percent of the returns were from persons operating no land. About 14 percent of the responses were from persons who operated land but had no livestock or poultry on hand at the time of the survey.

4.2.3 Land Reporting Study

Section I of the questionnaire included questions concerning the names and addresses of landlords, tenants, persons respondent manages land for, persons managing land for respondent, and the acres in each parcel of land. An attempt was made to secure reports from both persons involved in the rental or management operations. This was done to obtain an indication of the accuracy with which parcels of land are reported. There were 1045 of the 2637 questionnaires returned which listed other names under questions 4, 6, 8, and 10 (see Appendix E). Samples totaling 1167 were selected from the 1738 other names listed. One mailing was made which obtained a return rate of 26 percent. About 28 percent of the respondents reported a different acreage for the parcel of land rented or managed when compared with the original respondent's report (see Table 4.5). Some individuals were interviewed to find reasons for differences of more than 10 percent. Most of the differences could be reconciled; a few could not. In many cases the respondents' idea of the meaning of the terms rented, leased, managed, and partnership was not the same as ours. Differences in reported data are the result.

Table 4.5.--Summary of land reporting phase by states

Item	Illinois	Tennessee	Oklahoma	New Mexico	4-State Total
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Questionnaires with other names reported	262	247	354	182	1045
Number of other names listed	412	371	687	268	1738
Number mailed to	364	193	486	124	1167
Undeliverable	26	15	41	8	90
Returned by respondents	129	38	100	38	305
Number reporting different acres	30	20	15	20	85

5. June, 1967 Surveys

Experimental surveys were carried out in May and June of 1967 in conjunction with the SRS June, 1967 Enumerative Survey. The major objectives were to gain more experience with the use of the lists obtained, to evaluate the lists as sampling frames, and to show the advantages of the multiple frame methodology for making state estimates of sheep and poultry numbers.

5.1 Survey Design and Procedures

The lists obtained and used in the December, 1966 studies (Table 4.1) were used for the June, 1967 studies. The lists were updated and supplemented in some cases between the two surveys. The ASCS farm list was used for the June, 1967 cattle survey in Tennessee rather than the ARS list used in December 1966. The ARS list was out of date and experience with an ASCS list was desired.

Mail and non-response sample sizes and universe sizes are given in Table 5.1 for these surveys. The cattle lists in Oklahoma and New Mexico were stratified based upon the number of cattle listed on the tax rolls. The Tennessee cattle sample from the ASCS list was stratified by acres of land. The larger farms were sampled at higher rates than the smaller farms in each case.

The entire sheep and chicken lists were included in the mailed survey samples in Tennessee, Oklahoma and New Mexico. The non-respondents were stratified by size prior to selecting the non-response samples (except chickens in New Mexico where all non-respondents were enumerated).

The Illinois State Farm Census list for Crop Reporting Districts 4 and 5 was stratified into a large operator stratum plus eight additional strata based upon whether or not the operators listed cattle, sheep, and chickens on the State Farm Census.

Duplication which could be identified was removed from the lists prior to selecting the samples (except the Illinois State Farm Census where no attempt was made to remove duplication). In addition, each sample respondent was checked against the entire list after the survey field work was completed to determine duplications remaining in the lists. More complete names and addresses plus farm names were obtained during the survey to aid in identifying list duplication. The questionnaires used in the study included questions to help the respondent define his farming operation (the survey reporting unit) and a series of questions about the livestock associated with the unit. See Appendix F for examples of the questionnaires used in the June 1967 surveys.

Two mailings were made according to the mailing dates shown in Table 5.2. Questionnaires returned by mail were edited and classified as acceptable (complete and correct data given by respondent or the data could be corrected by editor) or as unacceptable. The unacceptable questionnaires were left in the non-response universes and had a chance of being selected in the non-response samples. Those which were selected were interviewed. The mail response rates (shown in Table 5.3) were lower than in the December 1966 survey. Reasons for this are (1) farmers are more apt to respond in December than in June since they are not as busy, (2) the survey period was longer in December and (3) only acceptable returns were counted in June. The response rates in the cattle survey were lower than in the other surveys.

A high percentage of the non-response subsamples were surveyed by telephone (see Table 5.4). Those who could not be reached by telephone were interviewed in person. The number of refusals was recorded. The refusal rate was under 10 percent

in each state and varied from 1.5 percent in Tennessee to 9.7 percent in Illinois. The refusal rate was higher in the cattle survey than in the sheep or chicken surveys (Table 5.5). The cattle farmers were less cooperative than sheep or poultry producers as mail survey response rates and refusal rates shown.

The SRS 1967 June Enumerative Survey was used as the area sample to make multiple frame estimates and to evaluate the lists. Tract operators (resident and non-resident) in the area sample were checked against the universe lists used to determine which operators were in the list universe. Additional information from the JES (such as farm names) was useful in matching. Separate expansions were made using JES data for (1) operations in the area sample and also on the list and (2) operations in the area sample and not on the list.

Table 5.1.--Sample sizes for June, 1967 multiple frame studies

Survey	Survey Area <u>1/</u>	List Size	Sample Size: Mail Survey	Sample Size: Non-response Survey
Cattle	Tennessee - CRD4	29,289	493	99
	Oklahoma - CRD5	14,610	523	98
	New Mexico - CRD3	4,862	501	149
Sheep	Tennessee	1,833	1,833	142
	Oklahoma	1,808	1,808	150
	New Mexico	1,658	1,658	149
Chickens	Tennessee	457	457	93
	Oklahoma	1,231	1,231	100
	New Mexico	60	60	34
Livestock	Illinois - CRD4 and 5	24,878	2,502	310

1/ CRD indicates Crop Reporting District. The sheep and chicken surveys in Tennessee, Oklahoma and New Mexico were state-wide.

Table 5.2.--Timing of the June, 1967 surveys

Operation	Tennessee, Oklahoma and New Mexico			
	Illinois	Cattle	Chickens	Sheep
First Mailing	:May 23	May 23	May 23	June 14
Second Mailing	:May 31	May 31	May 31	June 21
Select Non-response Sample	:June 7	June 7	June 7	June 29
Telephone Interviewing	:June 7-14	June 7-12	June 7-12	June 29-July 1
Personal Interviewing	:June 15-22	June 13-17	June 13-17	July 3-6

Table 5.3.--Mailed survey response rates, June, 1967 study
(Acceptable mailed returns)

State	Cattle Sample	Sheep Sample	Poultry Sample
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
Tennessee	18	30	29
Oklahoma	23	36	29
New Mexico	26	24	43
Illinois	(Livestock sample) - 29		

Table 5.4.--Percent of non-response sample completed by
telephone, June, 1967 study

State	Cattle Sample	Sheep Sample	Poultry Sample
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
Tennessee	60	67	68
Oklahoma	NA <u>1/</u>	96	82
New Mexico	50	51	94
Illinois	(Livestock sample) - 71		

1/ Not available.

Table 5.5.--Number of refusals and refusal rates, by states and by samples, June, 1967 survey

State	Cattle Sample		Sheep Sample		Poultry Sample		All Samples	
	Refusals	Refusal Rate	Refusals	Refusal Rate	Refusals	Refusal Rate	Refusals	Refusal Rate
	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Tennessee	3	3.0	1	.7	1	1.1	5	1.5
Oklahoma	6	6.1	15	10.0	5	5.0	26	7.5
New Mexico	10	6.7	2	1.3	0	.0	12	3.6
Illinois	----- (General livestock sample) -----						30	9.7
All States	19	5.5	18	4.1	6	2.6	73	5.5

5.2 Analysis

5.2.1 Multiple Frame Estimates

Two-frame estimates were computed from the data collected from the list and area samples. The formula $\hat{z} = \hat{x}_1 + p \hat{x}_2 + q \hat{y}$ was used to compute the estimates where

\hat{z} = multiple frame estimate,

\hat{x}_1 = area sample estimate of non-list universe,

\hat{x}_2 = area sample estimate of list universe,

\hat{y} = list sample estimate of list universe

and $p + q = 1$. Computing formulas for \hat{x}_1 , \hat{x}_2 and \hat{y} are found

in Appendix D. It was impossible to allocate the sample to both the area and list frames since the JES area sample was used without modification. Thus, the weighting factors p and q could not be optimized. By calculating the variances of the estimates using alternative sets of values for p and q , an approximate optimum weight was chosen for the fixed sample allocations. Variances were calculated for (p, q) equal to $(1.0, 0)$, $(.8, .2)$, $(.6, .4)$, $(.4, .6)$, $(.2, .8)$, and $(0, 1.0)$ with the optimum (p, q) chosen as the set which resulted in the lowest variance for the two frame estimate. Obviously, this procedure for choosing p and q should not be used when unbiased estimates are desired since the weights chosen must be independent of the survey results.

Tables 5.6, 5.7, 5.8 and 5.9 contain the "best" multiple frame estimates as defined above along with the June Enumerative Survey (area sample only) estimates and related data. The multiple frame estimates are more precise than the June Enumerative Survey estimates in nearly every case and the increases in precision are sizeable. This shows that significant increases in precision may be obtained for a very small added cost by sampling 2 frames as compared with estimates from the area sample alone. The list sample size and survey cost were small compared to the JES.

The tables mentioned above give the p values (weight for \hat{x}_2) for the "best" multiple frame estimate. A value of p which is close to zero (gives no weight to estimate of list universe from area sample) would be optimum for most variables. This

is dependent upon the relative costs and variances in the 2 frames, the sampling design, and the list coverage.

5.2.2 Evaluation of List Frames Used

Fairly complete lists are desirable since the lists can usually be sampled more efficiently than the area frame. The column headed "List Coverage" in Tables 5.6, 5.7, 5.8 and 5.9 is an estimate of the proportion of the item estimated that is associated with the list. For example, the sheep list used in Tennessee contained about 68 percent of the sheep farms and from 86 to 92 percent of the sheep.

The lists used in the surveys were suitable for use in multiple frame sampling. In every case, the lists accounted for a larger proportion of the animals than farms. This indicates the larger farms were on the lists. The coverage for the sheep lists was 90 percent or better for New Mexico and Tennessee and about 55-60 percent for Oklahoma. The small estimated coverage in Oklahoma is due to the inclusion of 2 large sheep farms in the area sample which were not found on the wool filings list. Evidently these farms did not sell wool in 1967.

The chicken lists in the 3 States covered a sizeable part of the universe despite the small number of units on the lists.

The cattle lists were 70-90 percent complete for total cattle. The Oklahoma and New Mexico tax lists were more complete for cattle than the Tennessee ASCS List.

The Illinois State Farm Census was the most complete list studied and apparently covers nearly all of the hogs, 70 percent of the cows 2 years and older, 92-95 percent of the milk cows and 90-100 percent of the farm chickens.

Table 5.10 demonstrates how the list coverage affects the variability of the 2 frame estimate. Where the coverage of the list is low, \hat{y}_l , the area sample estimate of non-overlap, receives a large weight and, since it has a large variance, the variance of \hat{Z} is increased. One way to reduce the variance of the multiple frame estimator, particularly for minor items, is to increase the coverage of the list.

In some cases use of more than one list as a base list will accomplish this. The ASCS List for sheep in New Mexico was supplemented by state sanitary board lists. Further study shows that merging the 1965 ASCS sheep list for Oklahoma with the 1966 list would have increased the combined list coverage by about 10%.

5.2.3 Quality Check Studies

Subsamples of respondents from the sheep and chicken surveys were reinterviewed to evaluate the quality of the reported data. Supervisory personnel did this using a detailed questionnaire designed to accurately define the reporting unit as the total land the respondent operated. Since the quality check included samples of both mail and non-response returns, some comparisons of their relative accuracy were made. There were also questions to evaluate the accuracy of the list frames used. These questions determined the number of persons on the lists who were not farm operators, who did not have the specie of livestock wanted, and who did have the specie when the list was compiled.

The average acres operated and number of livestock on hand are shown in Table 5.11 for sheep and Table 5.12 for chickens. None of the differences in the average acres operated were statistically significant. Only one of the differences in number of sheep reported was significant; none of the differences in number of chickens reported were significant. It may be that no real differences existed or it could be that differences did exist but the samples were too small to detect them. The quality check survey found more sheep and chickens than the original survey.

When the individual data values are examined, the largest differences are for the number of chickens. Differences of several thousand birds occurred for some farms. Reasons for the differences were: (a) two different respondents reported for same operation, (b) respondent estimated data once and took it from records the other time, (c) respondent failed to give correct information on first report, and (d) respondent failed to associate chickens with land operated. Data collected by mail and interview were reported with about the same accuracy.

Respondents reporting no sheep (or chickens) were asked whether they had the specie previously and whether they intended to have any in the future. This gave information on the deadwood in the lists. This is summarized in Table 5.13 for sheep and Table 5.14 for chickens.

Although no quality check survey was carried out for cattle, some of this data was collected in the cattle survey itself. Results are shown in Table 5.15.

Table 5.6.--Multiple frame sheep estimates, June, 1967 study

Item and state	Multiple frame					June enumerative survey	
	List Estimate	Estimate	C.V.	"P" <u>1</u> /	List Coverage	Estimate	C.V.
	<u>Number</u>	<u>Number</u>	<u>Percent</u>	<u>Weight</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
New Mexico:							
All sheep and lambs (open)	739,621	758,921	4	0	97	862,143	40
All sheep and lambs (closed)	739,621	761,762	4	0	97	1,102,254	28
Breeding ewes	540,891	549,498	3	0	98	448,665	38
Sheep farms	1,179	2,138	18	0	55	1,764	41
Tennessee:							
All sheep and lambs (open)	75,405	81,651	8	0	92	80,142	44
All sheep and lambs (closed)	75,405	87,520	10	0	86	94,570	34
Breeding ewes	50,059	50,608	5	0	99	47,595	49
Sheep farms	1,554	2,278	19	0	68	2,508	42
Oklahoma:							
All sheep and lambs (open)	98,527	174,413	17	0	56	426,611	44
All sheep and lambs (closed)	98,527	166,677	17	0	59	350,145	46
Breeding ewes	70,705	105,724	14	0	69	215,085	40
Sheep farms	1,369	4,563	17	0	30	4,195	22

1/ Weight applied to June Enumerative Survey estimate of overlap domain.

Table 5.7.--Multiple frame chicken estimates, June, 1967 study

Item and state	Multiple frame					June enumerative survey	
	List Estimate	Estimate	C.V.	"P" <u>2/</u>	List Coverage	Estimate	C.V.
	<u>Number</u>	<u>Number</u>	<u>Percent</u>	<u>Weight</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
New Mexico:							
Chickens - all ages (open)	: 649,991	885,080	6	0	73	619,596	9
Chickens - all ages (closed)	: 649,991	950,483	7	0	68	692,715	9
Hens and pullets of laying age	: 468,034	690,940	6	0	77	400,767	8
Young chicks and pullets	: 179,163	243,060	10	0	74	189,538	13
Pullets and pullet chicks	: 177,591	208,638	5	0	85	---	---
Chicken farms	: 55	7,402	17	0	7	7,353	18
Tennessee:							
Chickens - all ages (open)	:5,081,552	10,305,644	25	.2	49	10,077,033	40
Chickens - all ages (closed)	:5,081,552	10,678,493	24	.2	48	10,454,149	38
Hens and pullets of laying age	:4,063,311	8,507,821	26	0	48	8,202,825	45
Young chickens and pullets	:1,274,811	1,723,237	23	.4	74	---	---
Chicken farms	: 386	77,623	6	.4	5	80,215	6
Oklahoma:							
Chickens - all ages (open)	:1,366,663	3,427,874	15	0	40	2,940,102	20
Chickens - all ages (closed)	:1,366,663	3,564,360	15	0	38	3,742,331	24
Hens and pullets of laying age	:1,159,704	2,453,218	15	0	47	2,045,148	22
Young chickens and pullets	: 467,119	1,112,316	<u>1/</u>	0	42	---	---
Farms with chickens	: 892	42,379	8	0	2	40,704	8

1/ Not computed.

2/ Weight applied to June Enumerative Survey estimate of overlap domain.

Table 5.8.--Multiple frame cattle estimates, June, 1967 study

Item and state	Multiple frame				June enumerative survey		
	List Estimate	Estimate	C.V.	"P" <u>4/</u>	List Coverage	Estimate	C.V.
	<u>Number</u>	<u>Number</u>	<u>Percent</u>	<u>Weight</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
New Mexico <u>1/</u> :							
All cattle and calves (open)	:834,835	943,387	8	0	88	601,060	22
All cattle and calves (closed)	:834,835	999,963	8	0	83	888,719	21
Cows and heifers 2+	:341,034	371,561	7	0	92	273,545	31
Cattle farms	: 4,049	5,442	11	0	74	5,482	20
Tennessee <u>2/</u> :							
All cattle and calves (open)	:495,456	662,362	11	0	75	622,306	13
All cattle and calves (closed)	:495,456	807,233	11	.4	61	906,821	11
Cows and heifers 2+	:264,859	354,170	10	0	75	332,044	14
Cattle farms	: 10,734	26,331	9	.8	41	28,297	9
Oklahoma <u>3/</u> :							
All cattle and calves (open)	:784,355	868,838	7	0	90	702,058	24
All cattle and calves (closed)	:784,355	925,358	7	0	85	769,336	11
Cows and heifers 2+	:368,621	410,991	8	0	90	352,827	22
Cattle farms	: 14,409	18,774	8	0	77	12,582	14

1/ Crop Reporting District 3 (plus Lincoln County)

2/ Crop Reporting District 4

3/ Crop Reporting District 5

4/ Weight applied to June Enumerative Survey estimate of overlap domain.

Table 5.9.--Multiple frame livestock and poultry estimates - Illinois 1/, June, 1967 study

Item	Multiple frame				June enumerative survey		
	List Estimate	Estimate	C.V.	"P" <u>2</u>	List Coverage	Estimate	C.V.
	Number	Number	Percent	Weight	Percent	Number	Percent
Hogs:							
All hogs and pigs (open)	:1,984,132	2,022,236	11	.2	98	1,400,318	21
All hogs and pigs (closed)	:1,984,132	1,806,783	10	.4	100	1,338,566	19
Hogs and pig farms	: 11,096	12,968	7	.2	86	11,615	13
Cattle:							
Cows and heifers 2+	: 190,679	264,017	17	.2	72	256,666	22
Calf crop	: 190,582	233,920	---	.2	83	198,607	---
Total Milk Cows (open)	: 26,108	28,519	19	.2	92	26,428	52
Total Milk Cows (closed)	: 26,108	27,579	17	.2	95	21,725	33
Milk cow farms	: 3,093	3,878	15	.2	80	4,040	24
Chickens:							
Hens and pullets - laying age	: 509,819	469,725	17	.4	100	337,658	26
Young chickens and pullets	: 239,087	262,212	22	.2	91	354,712	38
from this year's hatch	:						
Chicken farms	: 4,647	6,149	12	.2	76	6,129	20

1/ Crop Reporting Districts 4 and 5.

2/ Weight applied to June Enumerative Survey estimate of overlap domain.

Table 5.10.--How list coverage affects the precision of 2-frame estimates for minor items, all sheep, June 1, 1967

Type of estimate and state	Coefficient of variation for:			List Coverage
	Area sample estimate of non-overlap domain	List estimate of overlap domain	Multiple frame estimate of universe	
	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>	<u>Percent</u>
Survey estimates:				
New Mexico	35	3.6	4	97
Oklahoma	39	4.2	17	56
Tennessee	73	5.3	8	92
Survey estimates obtained by varying the list coverage:				
Tennessee	73	5.3	6	96
Tennessee	63 <u>1/</u>	5.3	13 <u>2/</u>	80 <u>1/</u>
Tennessee	53 <u>1/</u>	5.3	21 <u>2/</u>	60 <u>1/</u>

1/ Hypothetical value assumed.

2/ Computed value.

Table 5.11.--Sheep survey, quality check data compared to data originally reported, June, 1967

State and method of data collection	Sample Size	Average no. of acres*		Average no. of head*	
		Original	Check	Original	Check
		<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Mailed returns:					
New Mexico	47	28,820	28,846	2,456	2,524
Oklahoma	25	579	583	116	117
Tennessee	25	196	194	37	38
Non-response returns:					
New Mexico	35	15,536	16,471	2,007	2,075
Oklahoma	25	677	671	157	153
Tennessee	22	258	254	48	47

* Unweighted averages

Table 5.12.--Chicken survey quality check data compared to data originally reported, June, 1967

State and method of data collection	Sample Size	Average no. of acres*		Average no. of birds*	
		Original	Check	Original	Check
		<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Mailed returns:					
Oklahoma	25	269	266	9,142	9,255
Tennessee	24	190	194	5,907	7,512
Non-response returns:					
Oklahoma	25	199	209	2,751	3,154
Tennessee	23	216	218	10,330	11,527

* Unweighted averages

Table 5.13.--Sheep survey quality check evaluation of lists used, June, 1967

Item	State		
	New Mexico	Oklahoma	Tennessee
	<u>Number</u>	<u>Number</u>	<u>Number</u>
Sample size	100	50	48
Number not farming	4	3	3
Number farming and:			
(a) reporting sheep	86	40	41
(b) reporting zero sheep	10	7	4
Number reporting zero sheep who:			
(a) had sheep in past	10	4	4
(b) intend to have sheep again	3	1	0

Table 5.14.--Chicken survey quality check evaluation of lists used, June, 1967

Item	State	
	Oklahoma	Tennessee
	<u>Number</u>	<u>Number</u>
Sample size	50	50
Number not farming	3	0
Number farming and:		
(a) reporting chickens	40	43
(b) reporting zero chickens	7	7
Number reporting zero chickens who:		
(a) had chickens in past	6	6
(b) intend to have chickens again	0	1

Table 5.15.--Cattle survey, evaluation of lists used, June, 1967

Item	State		
	New Mexico	Oklahoma	Tennessee
	<u>Number</u>	<u>Number</u>	<u>Number</u>
Questionnaires completed	283	218	190
Number not farming	24	4	22
Number farming and:			
(a) reporting cattle	247	212	148
(b) reporting zero cattle	12	2	20
Number reporting zero cattle who:			
(a) had cattle in past	10	2	9
(b) intend to have cattle again	4	2	0

5.2.4 Problem Areas

The June 1967 surveys focused attention on a number of problem areas. A brief description of the problems is included here.

In order to properly use the multiple frame technique, it is necessary to determine whether or not each farm unit in the area sample is associated with the list being sampled. This is called identifying the overlap between the two frames.

The probability of erroneously calling two different individuals a match is thought to be fairly low. On the other hand, there are many chances to fail to match the same individual on two lists. Thus, there is probably a greater chance of failing to identify overlap farms than of falsely identifying non-overlap farms as overlap. The net effect tends to be in an underestimate of the overlap portion with a corresponding (but not offsetting) overestimate of the non-overlap portion of the universe. The weights applied to these two estimates in multiple frame estimating lead to a positive bias in the two-frame estimators. This is illustrated by the fact that the multiple frame estimates computed are high compared with the area frame estimates in most cases. Research is needed to find new and better ways of determining overlap and duplicates within lists if the estimators from large scale multiple frame surveys are to be unbiased. Table 5.16 illustrates the effect of failing to identify all of the overlap in the area sample. The first match consisted of checking June Enumerative Survey tract operators names (and addresses) against a printout of the Tennessee ASCS farm list. After completing the matching, JES operators not matched were checked again by contacting the county ASCS offices. Several of these operators were found on the ASCS list. Reasons for not finding them on the first match were: (a) used different names on the two records, (b) used nicknames on one of the records, (c) record failed to print when list printout was made, and (d) record out of order on printout. The upward bias in the estimated number of cattle due to an incomplete job of matching is illustrated by Table 5.16. This emphasizes the importance of detecting overlap between frames.

In Oklahoma, 22 JES operators reporting cattle were not matched with the tax list. The county tax assessor's offices were visited to determine if the 22 non-matches were on the tax list. Eleven of the names were not present. Seven were assessed with no cattle so did not appear on our list (made up of those assessed for cattle). The other four operations were assessed for cattle but we missed them when the list was obtained. One

Table 5.16.--Effect of incomplete determination of overlap, multiple frame cattle estimates
Tennessee 1/, June, 1967

Item	Area sample estimate	Multiple-frame estimate		List coverage Estimated percent of total	
		based on first match	based on second match	based on first match	based on second match
	<u>Number (000)</u>	<u>Number (000)</u>	<u>Number (000)</u>	<u>Percent</u>	<u>Percent</u>
All cattle (open)	622	888	662	56	75
All cattle (closed)	907	954	807	52	61
Cattle farms	28	27	26	40	41

1/ Crop Reporting District 4.

was assessed in the husband's name but the wife was the JES operator. One was a late assessment and the other two were missed for unknown reasons.

A similar and related problem is detecting duplication of units within the list frames. This kind of duplication, if not detected, also leads to upward-biased estimators. The same matching techniques will probably handle both the problems of overlap between frames and duplication within the list frame. Improved matching techniques are sorely needed.

Several problems were noted regarding communications with the survey respondents. Good questionnaire design and reporting instructions are a must so that respondents understand what the reporting unit is. This is doubly important when mailed surveys are used. In the December, 1966 survey, 43 percent of the mail questionnaires received required editing in Section I (defines the reporting unit as the total acres of land operated). The June, 1967 questionnaires were re-designed to make Section I more straightforward and easier to complete (see Appendix F). The new design did not help as 40 percent of the June questionnaires also required editing. The editors made subjective evaluations of whether they felt the editing corrected the problem. The results were: no editing required -- 60 percent; corrected by editing -- 38 percent; could not correct by editing -- 2 percent. The reliability of the editors' judgements is not known. Much remains to be done in finding better ways of communicating with respondents by mail and defining the reporting units.

Farming operations with complex tenure arrangements and large operating units may require special enumerating techniques and questionnaires to obtain the correct information. Procedures are also needed to handle out-of-state operators, multi-state operations, estates, corporations and institutional farms.

There is a timing problem with multiple frame surveys. The data collection has several phases and takes considerable time. Non-response interviewing can't begin until the mailed reports are in. The survey period should be short in order to relate survey data to particular calendar dates and to allow quick publication of survey estimates.

6. Other Studies

A number of other areas relating to multiple frame sampling were investigated from July, 1967 to June, 1968. These studies attempted to solve problems observed in the earlier phases of the project.

6.1 Costs of Obtaining Lists

The lists for the project were secured from several sources, according to their availability and suitability for sampling. This section deals briefly with the methods and costs of obtaining the lists used for cattle surveys. The ASCS Wool Filer's list, available yearly with no appreciable effort or expense, is not considered here. The poultry lists were quite small and were already in the SRS state offices, so that obtaining the poultry lists was no problem.

6.1.1 Illinois

The Illinois State Farm Census is taken yearly by the local tax assessors. The names and addresses of farm operators are recorded along with the acreages of various crops harvested the previous season, numbers of livestock on farms at the beginning of the year, cattle marketed the previous year, sows farrowed and the number of fruit trees present. All of the data collected is keypunched and summarized each year so that a good sampling frame for multiple frame surveys in Illinois was already available in the state office on punched cards.

6.1.2 Tennessee

A list of Tennessee cattle producers compiled by the Agricultural Research Service in connection with their disease control programs was originally obtained and used for sampling during the early stages of the project. This list was maintained on IBM cards at a nearby ARS station and thus there were no problems associated with obtaining this list or automating it. A duplicate deck of cards was prepared for the portion of the state desired. Experience with the ARS list indicated that it was badly out of date. Since there was no provision for updating the list, the later studies used the ASCS list.

The Tennessee SSO obtained the ASCS farm list without cost in the Spring of 1966. The list was in the form of addressograph plate impressions printed on three by five inch cards. The list size was approximately 200,000 records. Farms of less than 10 acres were later excluded, eliminating about 24,000 records. Although the ASCS record contained the name and address of the owner, only the operator's name and address, ASCS farm number, total land in farm and total cropland were keypunched. Obvious duplication of operators was eliminated before the list was keypunched in the Summer and Fall of 1966.

6.1.3 Oklahoma

The tax assessor's list for 14 Central Oklahoma counties was obtained. Data were obtained from about 15,000 individual tax assessment forms using a microfilm camera in 12 counties and by hand listing in two counties. A portable Recordak model RP-1 microfilm camera borrowed from the State ASCS was used to film the tax forms. Within a county, the assessment forms are usually kept in alphabetical order within townships, a useable order for sampling purposes, and the documents were filmed in this order. The RP-1 camera films documents 12 inches or less in width and of any length. A 100 foot roll of 16 mm film, with proper identification and index spacing, will cover approximately 1,400 tax assessment forms.

The principal advantage of using microfilm to obtain a list is the reduced cost, as shown by Tables 6.1 and 6.2. Records can be microfilmed from five to eight times faster than the name, address and control data can be hand listed. Note (Table 6.5) that 447 names per hour were obtained in microfilming vs. 56 names per hour by hand listing. The time saving more than offsets the added costs of the film, development and microfilm reader rental. The cost of renting the reader was included in Table 6.1 although it was not strictly speaking a cost of obtaining the list. Speed is also a factor in obtaining access to the tax forms at certain times of the year. Some assessors who would have refused a two-day access to their records during April would give us access to the records for the two to four hours required per county. Also, when a document is microfilmed, you have access to more information than would likely be hand listed plus the ability to refer back to the original document when errors or questions come up later.

The list was keypunched directly from a Recordak model PVM Starmatic reader with a 24:1 lens which expanded the image on the screen to the original size of the tax form. The viewing area of the screen was 9 1/2 by 12 inches which made it necessary to look at the top and bottom portions of the tax forms separately. An improvised foot pedal permitted the keypunch operator to advance the film without taking her hands away from the keypunch machine. The keypunching operation took about 20 percent longer than keypunching from a hand listing would take. A reader with a larger screen (such as the Remington Rand Electronic AO reader) would allow keypunching at a normal rate and also would reduce the error rate.

6.1.4 New Mexico

A list of persons paying taxes on cattle in 1966 was obtained from the county tax assessors records for 12 New Mexico counties. A 3-M model 70 copying machine was used to obtain photocopies of the tax rolls (large bound books) in ten counties. Names, addresses, and number of cattle assessed were hand copied in one county and the tax assessor listed the information for SRS in another county.

The copying machine was slow since it was necessary to lift the machine off the tax book after each page was copied, turn the page and then lift the machine back on the book to photograph the next page. This, plus the fact that the machine operated slowly, resulted in a higher cost for machine copying than for hand listing. Tables 6.3 and 6.4 show the cost by components. In Union County, the tax assessor listed 556 cattle producers for \$23.68 under contract. This cost \$4.26 per 100 names compared with \$4.52 for hand listing by SRS personnel and \$7.74 per 100 names using the copying machine.

An ASCS list for the entire state was also obtained in the Spring of 1968. There was little or no cost involved in obtaining this list as the county ASCS offices furnished a complete listing made from addressograph plates.

6.1.5 Conclusions

The cost of obtaining large lists for probability sampling can be quite high. The best situation would be to secure the necessary lists at no cost already on punched cards or magnetic tape. When this is not possible, however, lists will have to be obtained in other ways. Microfilming is the most efficient method used in this study. The rapid speed with which records can be filmed results in a significantly lower cost than either the portable photocopying machine or hand listing (see Table 6.5 for a summary of the cost and speed experienced in New Mexico and Oklahoma). It is possible that more efficient methods may exist.

After lists are secured, the information must be converted to machine media, usually punched cards. The costs of this conversion are considerable, usually greater than the cost of obtaining the list. Experience shows that it costs from \$6.50 to \$8.00 per 100 names for keypunching and verifying names, addresses and control data (number of cattle or acres in farm). Large amounts of money can be saved by obtaining lists such as the ASCS wool filers list which are already on machine media. In the future the agency will use such lists, when they exist and are available, to the fullest extent.

Table 6.1--Cost of obtaining tax assessment list using
microfilm camera, 12 counties, Oklahoma, 1967

Item	Cost	Cost per 100 names
	<u>Dollars</u>	<u>Dollars</u>
Film and developing (11 rolls at \$4.90)	53.90	.38
Mileage (1315 miles at 4.96 cents)	65.23	.46
Per diem and toll road fees	27.35	.19
Microfilm reader rental (\$20 per month, 6 month minimum)	120.00	.84
Salary (32 hours at \$2.50)	80.00	.56
Total cost	346.48	2.42

Table 6.2.--Cost of obtaining tax assessment list by hand
listing, 2 counties, Oklahoma, 1966

Item	Cost	Cost per 100 names
	<u>Dollars</u>	<u>Dollars</u>
Mileage (438 miles at 4.96 cents)	21.72	1.09
Per diem and toll road fees	11.46	.57
Salary (36 hours at \$2.50)	90.00	4.50
Total cost	123.18	6.16

Table 6.3.--Cost of obtaining tax assessor's list using a portable copying machine, 10 counties, New Mexico, 1967

Item	Cost	Cost per 100 names
	<u>Dollars</u>	<u>Dollars</u>
Copying machine rental	35.00	.79
Copying machine paper	47.71	1.08
Mileage	34.45	.78
Per diem	71.50	1.62
Salary (61 hours at \$2.50)	152.50	3.46
Total cost	341.16	7.74

Table 6.4.--Cost of obtaining tax assessor's list by hand listing, one county, New Mexico, 1967

Item	Cost	Cost per 100 names
	<u>Dollars</u>	<u>Dollars</u>
Mileage and per diem	9.40	2.06
Salary (4 1/2 hours at \$2.50)	11.25	2.46
Total cost	20.65	4.52

Table 6.5.--Cost of acquiring lists, New Mexico and Oklahoma
1966 and 1967

Method	Cost per 100 names <u>1/</u>	
	New Mexico	Oklahoma
	<u>Dollars</u>	<u>Dollars</u>
Copying machine	7.74 (72 names/hour)	---
Microfilm camera	---	2.42 (447 names/hour)
Hand listing	4.52 (102 names/hour)	6.16 (56 names/hour)

1/ Cost includes salary, mileage, per diem, equipment rental.

6.2 List Maintenance and Updating

Lists used in multiple frame sampling should be as complete and up to date as possible to obtain the greatest gains in precision. Once lists are obtained, they must be updated or an entire new list must be obtained periodically. What are the costs required for updating lists? How fast do lists go out of date? What kinds of changes and how many changes occur in the lists over time? The research on list maintenance and updating has attempted to answer some of the questions posed above.

6.2.1 Tennessee ASCS List

A project was begun to study the problems involved in updating the Tennessee ASCS list and to gain experience in keeping a large list up to date.

In February, 1966 the Tennessee SRS office arranged to receive a complete listing of the ASCS farm operator list. The list was received from the 95 county ASCS offices on three by five inch cards which had been stamped with the ASCS farm number, operator's name and address, owner's name and address, acres in the farm and acres of cropland. The list of 200,000 ASCS contracts was reduced to 176,000 by excluding farms smaller than 10 acres. Some operator duplication was removed prior to keypunching. The need to update was recognized after noting the changes occurring in the lists the first year and a half. The list was put on magnetic tape to reduce the time required for the sorting and collating needed for maintenance, sample drawing and duplication checks.

The list was transcribed from punched cards to magnetic tape in August, 1967. The tapes were sent to the Washington Data Processing Center. Sorts were made and printouts were obtained. A printout in alphabetic order over the entire state was used to check cross county duplication. An alphabetic printout within counties was useful to check duplication within counties. Another printout in ASCS farm number order was needed for making comparisons with addressograph plate files in each county. This was a part of the updating process. Copies of the latter two printouts were given to the ASCS as compensation for their giving the lists to SRS. The county offices keep their lists in farm number order and have no machine sorting facilities.

Three county ASCS offices were visited in late 1967 to get an objective measure of the list deterioration since early 1966. The current ASCS list was compared with the list obtained earlier for Marshall, Naurv and Summer counties. About 15

to 20 percent of the units had changed and were out-of-date.

A system for updating was defined and computer programs were written to update the master tape file. First, the file was updated for changes made from the Spring of 1966 until January of 1968. A current listing of the ASCS addressograph plates was obtained on adding machine tapes in January, 1968. The current listings were compared with computer printouts of the SRS list. Additions and deletions were identified. Change cards were keypunched and used to update the master file.

A sample of 20 counties was selected for an updating experiment. The number of additions and deletions occurring over a 23 month period are shown in Table 6.6. The yearly change is computed assuming that the changes occurred uniformly over the 23 months. From Table 6.6 one can see that about 12 to 13 percent of the units on a list would drop out during the course of a year. When the updating is done, there is nearly a one-to-one correspondence between adds and deletes. The total yearly changes are about 25 percent of the total list units.

Table 6.7 shows a record of the kinds of changes made, as tabulated for 7 of the counties. Multiple changes were counted; that is, a change of farm operator might involve a name change, address change and zip code change.

The Data Services Branch, Survey and Data Division, assisted on this phase of the project by keypunching and verifying the deletion records. The Systems Development and Programming Branch, Survey and Data Division, did the computer programming for the updating.

The State ASCS Committee directed each of the county offices to submit a record of changes occurring in the addressograph files after January 1, 1968 to the Tennessee SRS office. ASCS Form-12 was modified to include a place for recording addressograph impressions of ASCS farms added and deleted on a current basis. Copies of the Form-12's were sent to the Tennessee SRS office periodically by each county ASCS office. These forms were used to update the master file for changes occurring after January 1, 1968. The list has been updated several times, all after July 1, 1968. Analyses of the time and costs of updating along with the number of changes which occurred will appear in a later report. A verification of the updating accuracy is also planned.

Table 6.6.--Record of updating Tennessee ASCS list from February 1, 1966 through January 1, 1968, 20 counties

Item	Changes		Total on List
	Number	Number	
Number on list February, 1966			44,927
number of additions	12,321		
number of deletions	10,381		
Number on list January 1, 1968			46,867
total changes	22,702		
changes per one year period	11,850		
Yearly changes as a percent of total on list			25.3%

Table 6.7.--Kinds of changes occurring in the Tennessee ASCS list, February 1, 1966 to January 1, 1968, 7 counties

Kinds of changes	Changes from February 1966 to January 1968		Changes per year		Yearly changes as percent of total list
	Number	Percent	Number	Percent	
New farm number added	852	18	445		2.6
Old farm number deleted	606	13	316		1.8
Name changed	976	20	509		3.0
Address changed	667	14	348		2.0
Zip code changed	129	3	67		.4
Acres in farm changed	989	21	516		3.0
Crop land acres changed	544	11	284		1.6
All changes	4763	100	2485		14.4
Total number on list, 1966 ----- 17,426					

Table 6.8.--Costs of updating the Tennessee ASCS list from February 1, 1966 to January 1, 1968, 20 counties

Item	Cost	Cost per 1 year period	Yearly cost per 100 names on list
	<u>Dollars</u>	<u>Dollars</u>	<u>Dollars</u>
Comparing IBM printouts with current listing (406 hours at \$2.50)	1015.00	529.83	1.13
Keypunching and verifying deletions (52 hours at \$2.96)	153.92	80.35	.17
Collating deletion records out of cardsfile (22 hours at \$3.04)	66.88	34.91	.07
Reproducing deletion records (6 hours at \$3.21)	19.26	10.05	.02
Keypunching addition records (270 hours at \$2.96)	799.20	417.18	.89
Visual verification of keypunching additions (50 hours at \$2.50)	125.00	65.25	.14
Computer runs	1432.90	747.97	1.60
All items	3612.16	1885.55	4.02
Total number on list January 1, 1968 ----- 46,867 -----			

6.2.2 Oklahoma ASCS and Tax Assessor's Lists

Research on list maintenance in Oklahoma was aimed toward finding out the amount of change, the kinds of changes, and the updating costs for the ASCS list and the tax assessor's list. Lists obtained the previous year were available. Two different methods of updating were used.

The ASCS list was updated using a physical comparison of the previous year's list with an alphabetized list located in three county ASCS offices. Additions and deletions necessary to bring the one year old list up-to-date were hand listed. The procedure was laborious and time consuming; 56 hours making actual comparisons were required to complete three counties. Eight percent of the contracts on the old list had been deleted during the year, while 18 percent of the names on the updated list were new (see Table 6.9). This suggests that less than complete listings were obtained from the county offices in 1967. It might also indicate the ASCS list coverage was expanding. The increase in the list size was particularly large in Lincoln county. All three counties had more new contracts added than old contracts deleted. Table 6.10 shows a tabulation of the kinds of changes occurring in the ASCS list during the one year period studied. Changes in name, address and other miscellaneous changes where the farm number remained the same are shown as well as farm numbers added and deleted. Only the first change encountered, in the order listed in Table 6.10, was recorded for each farm number. Name changes related primarily to initials which had been omitted in keypunching the list, plus misspelled names. Other changes included zip code changes and keypunch errors. The costs of updating the ASCS using this method are given in Table 6.11; the total cost was \$2.99 per 100 names. These are the costs of obtaining the additions, deletions, and other changes and do not include the keypunching and verification costs necessary to update the list in the state office.

The tax assessor's list was updated for 11 counties in central Oklahoma in April, 1968. The individual tax forms for the current year were microfilmed with the same equipment and procedures used the previous year (Section 6.1.3). The 1967 list printout was visually checked against the 1968 tax forms as projected on a microfilm reader viewing screen. Deletions were marked on the printout and new names were listed for keypunching. Table 6.12 shows that about 92 percent of the listees were on the list both years. Eight percent of those

on the 1967 list were not on the 1968 list and nine percent of those on the 1968 list were new names. The tax list was more stable than the ASCS list from 1967 to 1968.

The additions and deletions to the list during the year by size groups (number of cattle) are indicated in Table 6.13. Most of the changes were in the smaller size groups, as might be expected. Comparisons of the changes by strata with the stratum sizes reveal that changes were approximately proportional to stratum sizes.

The next two tables give an indication of the changes in the cattle numbers listed by taxpayers in the two years. Table 6.14 shows for 10,609 matched comparisons, 38 percent reported more cattle in 1968 than in 1967, 28 percent reported less and 34 percent reported exactly the same number. Thus, to update control data yearly would require changes for 66 percent of the list units.

An alternative to updating the control data (number of cattle) is to record only the size group for each individual and update this information. Table 6.15 shows the number, of the same 10,609 matched cases, where the change in number of cattle listed was large enough to place the individuals in different size groups. There were 787 individuals moving to a larger size group and 501 to a smaller size group, compared with the previous year. About 12 percent of the matched cases changed size groups from 1967 to 1968 while the remaining 88 percent were in the same group both years. Thus, updating only size group identification changes only 12 percent of the units in a one year period compared with 66 percent if the number of cattle was updated. Recording only size group data is more efficient and equally satisfactory for stratification.

The field cost for updating the Oklahoma tax assessments list was about the cost of obtaining the list (Section 6.1.3). This is true since the entire list was microfilmed and the comparison necessary for updating was made later in the office. The advantage of updating, compared with keypunching the entire new list, is that fewer cards would need to be keypunched.

Table 6.9.--Analysis of updating of the Oklahoma ASCS farm number list, 3 counties, 1967 vs 1968

	Contracts on 1967 list	Contracts on 1968 list	Contracts on both lists		New contracts		Contracts not on 1968 list
	<u>Number</u>	<u>Number</u>	<u>Number</u> <u>Percent</u>		<u>Number</u> <u>Percent</u>		<u>Number</u> <u>Percent</u>
Canadian	3055	3155	2742 90		413 13		313 10
Creek	1954	2098	1879 96		219 10		75 4
Lincoln	2091	2739	1920 92		819 30		171 8
Total	7100	7992	6541 92		1451 18		559 8

Table 6.10.--Results of updating Oklahoma ASCS farm number list, 3 counties
1967 vs. 1968

Kind of change	Number of changes	Percent of total changes	Percent of total ASCS farm numbers
	<u>Number</u>	<u>Percent</u>	<u>Percent</u>
New farm number added	1451	60	18
Old farm number deleted	559	23	7
Name changed	237	10	3
Address changed	95	4	1
Other changes	60	2	1
All changes	2402	100*	30

* Does not add to total because of rounding.

Table 6.11.--Cost of updating and analysis, Oklahoma ASCS list,
3 counties

Item	Cost	Yearly cost per 100 names
	<u>Dollars</u>	<u>Dollars</u>
Salary (68 1/2 hours labor at \$2.50)	171.25	2.14
Mileage (625 miles at \$.05)	31.25	.39
Per diem \$36.50	36.50	.46
Total	239.00	2.99
Total names on list, 1968 -----		7992 -----

Table 6.12.--Results of updating of the Oklahoma tax assessor list, 11 counties, 1967 vs 1968

County	Names on	Names on	Names on		New names		Names not	
	1967 list	1968 list	both lists		Number	Percent	Number	Percent
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>	<u>Number</u>	<u>Percent</u>
Canadian	1189	1199	1103	93	96	8	86	7
Cleveland	826	840	763	92	77	9	63	8
Creek	1226	1249	1141	93	108	9	85	7
Kingfisher	1283	1320	1207	94	113	9	76	6
Logan	1074	1062	994	93	68	6	80	7
McClain	950	1003	870	92	133	13	80	8
Okfuskee	802	813	717	89	96	12	85	11
Oklahoma	477	467	410	86	57	12	67	14
Payne	1316	1323	1231	94	92	7	85	6
Pattowatomie	1414	1424	1268	90	156	11	146	10
Seminole	990	1011	905	91	106	10	85	9
All	11547	11711	10609	92	1102	9	938	8

Table 6.13.--Changes in units on the Oklahoma tax list, 1967 to 1968, 11 counties, by size group

County	New names on 1968 list					Names not on 1968 list				
	Number of cattle					Number of cattle				
	1-24	25-49	50-99	100 +	Total	1-24	25-49	50-99	100 +	Total
Canadian	70	17	6	3	96	67	16	3	0	86
Cleveland	64	10	2	1	77	50	10	2	1	63
Creek	94	9	30	2	108	74	11	0	0	85
Kingfisher	72	21	13	7	113	50	13	12	1	76
Logan	56	8	4	0	68	72	5	3	0	80
McClain	89	26	18	0	133	62	8	8	2	80
Okfuskee	81	7	7	1	96	70	9	3	3	85
Oklahoma	48	14	3	2	67	48	7	1	1	57
Payne	75	9	7	1	92	72	12	1	0	85
Pottawatomie	134	13	6	3	156	130	14	2	0	146
Seminole	84	15	6	1	106	73	7	4	1	85
Total	867	149	75	21	1112	768	112	39	9	928

Table 6.14.--Changes in number of cattle reported to tax assessors, Oklahoma, 1967 compared with 1968

County	Change in reported cattle numbers			
	Matched comparisons	Reported increase	Reported decrease	Reported no change
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Canadian	1103	514	359	230
Cleveland	763	285	202	276
Creek	1141	407	277	457
Kingfisher	1207	539	331	337
Logan	994	325	334	335
McClain	870	344	257	269
Okfuskee	717	207	163	347
Oklahoma	410	157	93	160
Payne	1231	463	422	346
Pottawatomie	1268	437	310	521
Seminole	905	328	224	353
All counties	10609	4006	2972	3631
Percent of total	(100%)	(38%)	(28%)	(34%)

Table 6.15.--Oklahoma tax list, changes in size groups by individual listees, 1967 vs. 1968 assessed number of cattle, 11 counties

		<u>Size group 1967 list</u>			
		1-24	25-49	50-99	100 +
Size group 1968 list	1-24	---	282	21	4
	25-49	395	---	134	9
	50-99	36	247	---	51
	100 +	4	14	91	---

6.2.3 New Mexico Tax Assessor's List

The tax assessor's list for 14 New Mexico counties was updated by comparing a printout of the 1966 list with the 1967 list. Updating was a manual process of comparing alphabetical county printouts with the county tax rolls, which were arranged alphabetically by school districts. Deletions were lined out on the IMB printout; additions were hand listed.

A 12 percent change in the number of persons paying taxes on cattle was observed during the one year period (see Table 6.16). The total number of names was about the same for the two years. Only changes of names were recorded and changes in control data (number of beef cattle) were not made. Changes in the number of beef cattle listed occurred in over half of the matched cases. The amount of change was relatively small in most cases.

Most of the additions and deletions were associated with the smaller size groups (see Table 6.17). Percentage wise, the amount of changes due to the additions and deletions would average 12 percent overall and varies from 14 percent in the 100-499 group to about 8 percent in the 1500 + group.

The costs of updating shown in Table 6.18 are quite high due to the fact that the job had to be done manually. Two persons did the updating at the State Tax Commission Office in Santa Fe.

6.2.4 Summary

The amount of change in the lists studied was from 9 to 13 percent annually. The number of deletions was usually about equal to the number of additions. Reasons for changes were numerous and varied. The greatest volume of changes were associated with the smaller operations, but nearly proportional to the number of units on the list.

The control data (number of cattle) on the tax lists changed from one year to the next in about 2/3 of the matched cases, suggesting that it would be expensive to update this information. This suggests that it might be better to obtain a new list periodically rather than to update a list. As an alternative, it may not be necessary to update the exact cattle numbers but just the size groups information. The control data changed enough to place the list units in different size groups in only about 12 percent of the matched cases. This was for a fairly typical situation of using four size groups for cattle numbers.

The costs of updating were considerable as were the costs of obtaining the lists originally. The alternative to updating is to keep the same list for several years and then obtain an entire new list. It appears that lists can be updated annually for about the same total cost, including data processing, as the alternative of no updating but obtaining and keypunching a new list every three years. This is because fewer documents would be keypunched with an updating procedure. The more complete list will generally result in more precise multiple frame estimators, assuming the usual survey costs, variances and sample designs. A list that is 80 percent complete when obtained may be only 72 percent complete when sampled the first time and 65 percent complete when two years old.

A computerized system of updating was developed for the Tennessee ASCS list. It is almost mandatory that very large lists be put on to magnetic tape in order to keep up with changes, draw samples from the list and obtain printouts of the list in various sequences. Future work should include an evaluation of the accuracy of the updating job done by this system. The costs for future updating should decrease since the cost data given in this report include some developmental and system debugging costs.

Table 6.16.--Updating of the New Mexico tax assessor's list, 14 counties, 1966 vs. 1967.

County	Names on	Names on	Names on		New names		Names not	
	1966 list	1967 list	both lists		Number	Percent	on new list	
	Number	Number	Number	Percent	Number	Percent	Number	Percent
Catron	298	311	258	87	53	17	40	13
Curry	435	477	409	94	68	14	26	6
De Baca	188	200	166	88	34	17	22	12
Grant	264	276	253	96	23	8	11	4
Guadalupe	254	281	222	87	59	21	32	13
Harding	245	260	223	91	37	14	22	9
Hidalgo	191	196	175	92	21	11	16	8
Lea	339	365	306	90	59	16	33	10
Lincoln	275	292	253	92	39	13	22	8
Nora	430	430	383	89	47	11	47	11
Quay	652	648	573	88	75	12	79	12
Rio Arriba	818	690	643	79	47	7	175	21
Roosevelt	686	689	616	90	73	11	70	10
Sandoval	160	163	151	94	12	7	9	6
Total	5235	5278	4631	88	647	12	604	12

Table 6.17.--Changes in units on the New Mexico tax assessor's list, 1966 to 1967, 14 counties, by size groups

County	Names not on 1967 list					New names on 1967 list				
	Number of cattle					Number of cattle				
	1-99	100-499	500-1499	1500+	Total	1-99	100-499	500-1499	1500+	Total
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Catron	35	5	0	0	40	30	21	2	0	53
Curry	21	5	0	0	26	59	9	0	0	68
De Baca	14	7	1	0	22	21	13	0	0	34
Grant	9	2	0	0	11	14	9	0	0	23
Guadalupe	29	3	0	0	32	37	20	2	0	59
Harding	14	6	2	0	22	23	8	5	1	37
Hidalgo	13	3	0	0	16	15	5	1	0	21
Lea	25	7	1	0	33	46	11	2	0	59
Lincoln	18	3	1	0	22	26	12	1	0	39
Mora	43	1	3	0	47	36	8	2	1	47
Quay	67	10	2	0	79	64	10	1	0	75
Rio Arriba	157	18	0	0	175	41	5	0	1	47
Roosevelt	60	10	0	0	70	63	10	0	0	73
Sandoval	8	1	0	0	9	9	2	1	0	12
Total	513	81	10	0	604	484	143	17	3	647

Table 6.18.--Cost of updating the New Mexico tax assessor's list, 14 counties

Item	Cost	Yearly cost per 100 names
	<u>Dollars</u>	<u>Dollars</u>
Salary (40 hours at \$2.50)	100.00	1.89
Mileage (700 miles at \$.05)	35.00	.66
Per diem (8 days at \$13.00)	104.00	1.97
Total	239.00	4.53*
Total names on list, 1967 -----		5278 -----

*Detail does not add to total because of rounding.

6.3 List Duplication

The amount of duplication in the New Mexico ASCS list was studied. This list was acquired by the New Mexico SSO early in 1968 for crop surveys. The ASCS list was also compared with a New Mexico tax list.

6.3.1 Duplication in an ASCS List

The New Mexico SSO was able to get the ASCS list at no expense through an agreement with the State ASCS Director. The names came from the ASCS master list of farm owners and operators. The names were printed from addressograph plates on legal size paper. The names were reviewed and coded for keypunching.

The lists were fairly consistent but variations did exist between counties. Where discrepancies appeared to exist, the lists were sent back for verification. Each name (operator) was associated with a cropland acreage and total land acreage. There were considerable differences between the two figures. This was expected in New Mexico with large acreages of range land and non-cropland on most of the operating units. However, the relative amount of this non-cropland included by ASCS varied among counties. Some counties attempt to get all farmers and ranchers to sign up regardless of their program participation. Some ASCS offices would record the large ranches in the following manner: all land in farm, 100,000 acres, cropland acres, 0. The cropland acres was keypunched for use as control data rather than all land in farms. Table 6.19 shows the number of names punched in each county and the number of within-county duplications. Only the definite **duplicates (same name and address) were combined** as shown in the table.

After each county list was verified the cards were sorted alphabetically. Duplication was determined from alphabetical printouts. The duplicated cards were pulled out and new cards were prepared. The cards were coded to show duplication and placed back in the file. Checks were made among the major counties for duplications. Only 82 duplicated names were found in this check (see Table 6.20). Within counties, the list contained about 13 percent positive duplications of farm operators. An additional two percent were possible duplications. A small number (about one-half of one percent) were cross-county duplications.

The plan was to use the ASCS list for beefing up the non-probability lists, primarily the crop list used for the

Acreage and Production Survey. The ASCS list gave a relative measure of size which was not available before. It also identified most of the large crop farm operations in the State.

6.3.2 Matching a Tax List Against an ASCS List

The tax assessor's list for 1967 was compared with the 1968 ASCS list for 11 counties. Only 57 percent of those on the tax list also appeared on the ASCS list (Table 6.21) This might be because only those paying taxes on cattle were obtained from the tax office. Many cattle producers do not participate in ASCS programs.

Considerable work is needed to find improved ways of matching farms, names and sampling units. This is a problem both within and between frames.

Table 6.19.--Within county duplication in the New Mexico ASCS list, 1968

County	Total Cards	Duplicated names		Possibly duplicated		Net Farmers	Number of farms 1964 census
		Names	Cards	Names	Cards		
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>
Bernalillo	339	2	4	1	3	337	334
McKinlev	96	0	0	1	2	96	95
Rio Arriba	632	2	4	5	10	630	1194
Sandoval	727	2	4	0	0	725	411
San Juan	573	1	2	2	4	572	511
Santa Fe	614	3	6	2	7	611	368
Taos	254	0	0	4	9	254	610
Valencia	585	7	14	1	2	578	688
Colfax	549	47	99	4	6	497	298
Curry	1256	200	491	9	21	965	717
De Baca	258	0	0	2	4	258	229
Guadalupe	853	5	10	0	0	348	223
Harding	274	26	57	3	6	243	220
Mora	295	0	0	0	0	295	466
Quay	1124	164	391	15	64	897	723
Roosevelt	1230	26	52	4	8	1204	1115
San Miguel	752	15	31	4	8	736	610
Torrance	722	90	212	7	13	600	293
Union	552	56	126	3	5	482	456
Catron	258	2	4	1	2	256	270
Grant	192	4	8	0	0	188	239
Hidalgo	193	13	31	1	1	175	173
Luna	220	42	87	5	8	175	260
Sierra	190	15	33	0	0	172	195
Socorro	422	34	78	2	2	378	288
Chaves	678	89	225	24	36	542	629
Dona Ana	1712	310	1131	31	158	891	869
Eddy	484	80	200	15	52	364	527
Lea	414	7	15	5	10	406	593
Lincoln	297	2	4	3	6	295	356
Otero	127	2	4	0	0	125	246
State							
Total	16372	1246	3323	154	447	14295	14206

Table 6.20.--Cross-county duplication in the
New Mexico ASCS list, 1968

County	Duplicate
	<u>Number</u>
Quay - Curry	22
Quay - Roosevelt	8
Quay - Harding	11
Quay - San Miguel	2
Eddy - Lea	0
Lea - Roosevelt	4
Colfax - Union	6
Mora - Harding	0
Chaves - Eddy	3
Curry - Roosevelt	<u>26</u>
All counties	82

Table 6.21.--Comparison of names on tax list with names on ASCS list, selected counties, New Mexico, 1968

County	Names on tax list	Names on ASCS list	Good matches	Probable matches	Names on both lists
	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Number</u>	<u>Percent</u>
Colfax	279	497	190	23	68
Curry	422	965	266	15	63
De Baca	186	258	120	7	65
Guadalupe	255	348	152	18	60
Harding	238	243	123	12	52
Mora	423	295	196	0	46
Quay	633	897	411	20	65
Roosevelt	603	1204	369	20	61
San Miguel	500	736	242	14	48
Torrance	347	600	178	11	51
Union	488	482	256	11	53
11 counties	4374	6525	2503	151	57

6.4 Defining Reporting Units

Problems in applying the multiple frame methods were noted earlier in the project. Farming operations with complex tenure arrangements as well as out-of-state operators, multi-state operators, estates, corporations and institutional farms require special handling to assure that the correct data is obtained and that the proper probability of selection is computed. Progress was made in some, but not all, of these problem areas in this project. A description of this work follows.

6.4.1 Poultry Contractors

A problem observed in the earlier work was that of associating chickens with the land operated by an individual. Some persons did not appear to consider the land where the chickens were located as part of their farming operation. Ownership of the chickens also appeared to be a factor in who would be able and willing to report the most accurate information. There was a strong possibility that some farmers growing chickens under contract would not be inclined to give survey information about the contract birds.

An alternative procedure was considered involving collection of data on contract birds from the contractors. It was not known whether or not the contractors had the type of current information needed for the SRS surveys. A group of contractors was visited to obtain basic data regarding their operations. The visits with 21 contractors in Illinois, Tennessee, and Oklahoma revealed the following information:

- A. The majority of the contracts were written. There are some verbal agreements but the larger contractors tended to have written contracts.
- B. The period covered by the contracts was varied. Many are for 14-16 months; some are as long as five years. Contracts can be terminated at any time provided both parties are agreeable. Most contractees remain with the same contractor for extended periods.
- C. The contractor usually provides the chickens, feed, medication, technical advice, bookkeeping service, insurance on the birds, picks up the eggs for marketing and pays taxes on the chickens.
- D. The contractor retains title to the chickens, feed and eggs at all times.

- E. The contractee furnishes the land, buildings, equipment and labor. He must maintain the facilities and manage the operation in a manner suitable to the contractor. The contractee usually has to keep records of eggs produced, deaths and feed consumed.
- F. The contractee is to allow no unauthorized persons to enter the area where the chickens are maintained and is to refrain from visiting other poultry farms. This is to avoid the spread of diseases.
- G. Agreements for compensation to the contractees are quite varied. Several examples are included in Appendix G.
- H. The contractor almost always knows the number of eggs produced during a recent period. He has a good idea of how many hens are on hand, but doesn't keep an exact record. He may or may not have an up-to-date record of death losses, but can estimate it fairly accurately.
- I. The contractors visited felt that the term "contractor" was understood by the contractees, although other terms such as dealer, feed company, hatchery, supplier and company are used in the written agreements or contracts.
- J. A list of contractees can be obtained from most contractors. An annual updating would probably be sufficient for SRS uses.

In summary, using the alternative of ownership as the association rule for chickens raised under contract would result in data equal or better in accuracy to the previously used association rule. Some gains in the precision of the estimates would also be expected, since (in many states) a few contractors account for a substantial fraction of the hens and pullets.

6.4.2 Out-of-State Operators

Persons who live in another state always pose enumerating problems in survey work. Methods of determining which operations (or parts of operations) are to be sampled for a particular state are needed. Individuals living far out of state, several states away, are usually present on any list. This causes delay and extra expense in collecting data.

The purpose of this phase was to examine the characteristics of persons reporting cattle on the New Mexico tax rolls but living in other states. There were 9433 persons who listed cattle on the tax rolls. Of these, 604 had out-of-state addresses. These 6.4 percent of the cattle operators had 12.3 percent of the cattle listed, indicating these operations were larger than average.

The 604 out-of-state names were screened for known operations in New Mexico (operators living in the state but getting their mail in a near by, out-of-state town or city). Only 36 cases of this type were found. A short questionnaire was mailed to the remaining 568 operators after the above 36 had been deleted. A second request was sent to those who had not responded after about ten days. There were 46 (8.1 percent) questionnaires returned by the post office as not deliverable. Respondents returned 384 questionnaires by mail, thus the response rate from two mailings was 67.6 percent. (see Table 6.22). None of the non-respondents were interviewed. The questionnaire was quite short -- questions were asked to determine whether the respondent owned land or livestock in New Mexico, the names(s) of the ranch(es) operated in New Mexico, name(s) and address(es) of local manager(s) and tenure information.

The respondents were grouped in several general categories as shown in Table 6.23. About 64 percent owned land in New Mexico; 69 percent owned or had part-interest in a livestock operation in New Mexico. A few turned out to actually live within the state. Twenty-one reports indicated seasonal grazing between New Mexico and Colorado. About three and one-half percent were involved in multiple operations, some or all of which were in New Mexico.

The majority of the respondents appeared to be bona-fide operators even though they lived far out of the state. This portion of the universe accounts for over 12 percent of the cattle listed on the tax rolls and they should not be deleted from the list. They would probably require telephone or personal contacts in sampling.

Those operators in this category who had more than 100 cattle listed on the tax rolls were identified to test their reporting on an SRS livestock survey. A June 1968 Livestock Survey card was mailed to each of the 135 out-of-state operators having 100 or more cattle listed on the tax rolls. There was no second request. Only 36 cards or 27 percent were returned by mail. Of the 36 cards, 18 were sent to out-of-state addresses and were filled out by the person on the list. Another 14 cards were mailed to and filled out by a manager or other person within the state (as a result of the special study). Only 3 of the cards mailed to local managers within the state had been forwarded to out-of-state headquarters. The average number of cattle reported by the 36 respondents was 893 head. While this was a small test, it does appear to be possible to obtain data from cattle operators living in other states. Local operating units would need to be defined, perhaps with a special

questionnaire or by telephone contacts. Multiple operating units need to be defined and data for local units obtained in survey work. Between-state exchanges of information are needed so that an operator will not be called upon to report the same data to more than one state. The headquarters rule should be used to determine which state (or county) to associate the smaller ranches with. Livestock on larger ranches should be pro-rated to states (and counties) based on the numbers of livestock or acres operated.

Table 6.22.--Study of out-of-state operators on tax list, mailing record and response rate, New Mexico, 1968

Item	Sample of out-of-state operators	
	Number	Percent
Questionnaires mailed	568	100.0
Returned by post office	46	8.1
Returned by mail	384	67.6
No response	138	24.3

Table 6.23.--Study of out-of-state operators on tax list, by type of respondent, New Mexico, 1968

Type of respondent	Out-of-state operators responding to questionnaire	
	Number	Percent
Local address and/or operator	106	27.6
No local address - but has New Mexico operation	126	32.8
Post Office out-of-state - but lives in New Mexico	17	4.4
Special problems <u>1/</u>	5	1.3
Seasonal grazing - headquarters out of state	21	5.5
No land or livestock in New Mexico	109	28.4
Total respondents	384	100.0

1/ Two feed lots in State, three very large multi-unit operations.

6.5 List Units vs. Reporting Units

The December 1966 survey work indicated that many persons responding to a mailed inquiry had difficulty completing the section on total land operated. Some respondents might have been confused by this section and this may have caused them to report incorrectly in later sections dealing with livestock on hand. The idea was advanced that some farmers are associated with only one farm or piece of land over a relatively short time span. This subset of farm operators would conceivably report for the same farm unit no matter who requested information (SRS, ASCS, State Farm Census, U.S. Census, Tax Assessor). Thus, if this group could be identified during the survey, it might not be necessary to define the reporting unit in great detail for them. Those with more complex farm operations would require special handling, probably telephone and personal followups, to assure that they reported their total land operated. Acres operated on the source lists were compared to acres operated as reported by the same individuals on SRS mailed surveys, where the only instruction is generally "report for the farm you operate". The thought was that when the acres reported on a survey agreed fairly closely with the acreage indicated on the source list, then the chances would be good that the farm operator was reporting for the correct area of land.

6.5.1 Illinois

The "total land in farm" from the 1967 June Acreage Survey reports and the 1967 December Livestock Survey (PMS) reports were compared with the total land in farm as reported on the 1966 and 1967 State Farm Census for a sample of ten counties.

As indicated in Tables 6.24 and 6.25, 70 to 80 percent of those reporting by mail appeared to report for approximately the same acreage (within 10 percent) as they had listed on the State Farm Census. About 50 percent reported exactly the same acreage. Assuming these individuals reported for their entire farming operation, then it might not be necessary to define the reporting unit in detail for them. Respondents not reporting the same acreage within reasonable tolerances, would be contacted to determine their reporting accuracy. Alternatively, those not reporting approximately the same acreages could be included in the non-response universe.

6.5.2 Tennessee

Reported total land in farm from 1967 Tennessee June Acreage Survey reports was compared with the total acres listed in the Tennessee ASCS records for the same individuals. Individuals

were credited with the acreage of all ASCS farms they operated in the county of residence.

Table 6.26 shows that in only about half of the cases did the two acreages agree within 10 percent.

6.5.3 Oklahoma

The acres operated according to the ASCS list was compared with the acres in farm as reported on the 1967 June Acreage Survey and the 1967 June Livestock Survey. Ten counties for the acreage survey and five counties for the livestock survey were selected. The reports were tabulated for all individuals reporting on the survey who could be matched with the ASCS list.

About 55 percent reported within 10 percent of their acreage on the ASCS list. About 40 percent reported exactly the same acres.

6.5.4 New Mexico

Reports received by mail on the March 1968 Acreage Survey were matched against an up-to-date ASCS list for 11 counties (Crop Reporting District 30). There were 475 cards in the survey and 435 were matched with the ASCS list. ASCS land in farms was compared with the farm acreage reported on the survey questionnaires.

Table 6.29 shows that about 56 percent of those matched reported the two acreages within 10 percent.

6.5.5 Conclusions

The results of these tabulations do not favor further research in this area. The number of persons reporting for the list acreage without detailed instructions was too small. Illinois might successfully apply the idea, but in Tennessee, Oklahoma, and New Mexico, a second contact would be required in approximately half of the cases to establish the reporting unit with the respondent. Thus, a series of questions to help the respondents determine the reporting units is necessary and the procedure should be used for the entire sample.

Table 6.24.--1967 June acreage survey reported acres vs. state farm census acres, Illinois

Two acreages are	June acreage survey vs 1966 state farm census		June acreage survey vs 1967 state farm census	
	Number	Percent	Number	Percent
Exactly the same	201	52	214	58
Within 5 percent	268	69	278	75
Within 10 percent	296	77	299	80
Within 20 percent	314	81	318	85

Table 6.25.--1967 December livestock survey reported acres vs. state farm census acres, Illinois

Two acreages are	December livestock survey vs 1966 state farm census		December livestock survey vs 1967 state farm census	
	Number	Percent	Number	Percent
Exactly the same	190	48	198	52
Within 5 percent	251	63	252	66
Within 10 percent	274	69	277	73
Within 20 percent	299	75	306	81

Table 6.26.--1967 June acreage survey reported acres
vs. ASCS acres, Tennessee

Two acreages are		June acreage survey vs. ASCS list	
		<u>Number</u>	<u>Percent</u>
Exactly the same	:	380	18
Within 5 percent	:	841	40
Within 10 percent	:	1053	51
Within 20 percent	:	1293	62

Table 6.27.--1967 June acreage survey reported acres
vs. ASCS acres, Oklahoma

Two acreages are		June acreage survey vs. ASCS acres	
		<u>Number</u>	<u>Percent</u>
Exactly the same	:	197	42
Within 5 percent	:	248	53
Within 10 percent	:	270	58
Within 20 percent	:	292	63

Table 6.28.--1967 June livestock survey reported acres vs. ASCS acres, Oklahoma

Two acreages are		June livestock survey vs. ASCS acres	
		<u>Number</u>	<u>Percent</u>
Exactly the same	:	79	39
Within 5 percent	:	94	46
Within 10 percent	:	107	53
Within 20 percent	:	120	56

Table 6.29.--1968 March acreage survey reported acres vs. ASCS acres, New Mexico

Two acreages are		March acreage survey vs. ASCS acres	
		<u>Number</u>	<u>Percent</u>
Exactly the same	:	NA	NA
Within 5 percent	:	218	50
Within 10 percent	:	243	56
Within 20 percent	:	273	63

NA = not available

7. Studies at Iowa State

Work on building list frames was carried on in the Spring of 1968 in cooperation with the Statistical Laboratory, Iowa State University. Two techniques were studied -- the snowballing procedure and the use of rural routes in sampling.

Lists of farm operators producing minor items were studied in Illinois, Tennessee, Oklahoma and New Mexico. The snowballing technique utilizes a starter list of probable producers of a minor commodity. A list frame for the item is developed through repeated mailing to and interviewing of new names which are given by the respondents. The minor items investigated were christmas tree growers in Illinois, beekeepers in Tennessee and Oklahoma, and apple producers in New Mexico.

Another list frame technique, which was developed by Iowa State, was tested in Tennessee and New Mexico. A first stage sample of cities was drawn and a second stage sample of rural routes emanating from the cities was selected. Farm operators on the selected routes were identified and the products produced on their farms were ascertained. This scheme is appropriate where a general purpose agricultural sample is desired. It could also be used for single item surveys after the list had been established and each producers' products identified. Due to its shape, a rural mail route is quite efficient and economical as a second stage sampling unit. The scheme offers flexibility in the sampling rates at which the various stage sampling units are selected. List updating would be fairly simple and inexpensive.

The results of these two studies are covered in separate reports from the Statistical Laboratory.

Appendix A

Standards and Research Division

INFORMATION FORM FOR SRS MULTIPLE FRAME PROJECT

Source Name _____

Date _____

Location _____

A. Coverage of the Universe:

B. Control Data:

1. Number of animals _____

4. Social Security No. _____

2. Size of farm _____ acres

5. Last Date of Participation _____

3. Acres of cropland _____

6. Telephone Number _____

Comments on the other points:

C. Availability of the List:

D. Cost:

E. How is the list filed and where:

F. Maintenance of the Source:

G. Sources of their Names:

H. General Comments:

Appendix B

United States Department of Agriculture
Statistical Reporting Service

Budget Bureau No. 40-S67127
Approval Expires January 31, 1968

INFORMATION FOR SRS MULTIPLE FRAME SAMPLING STUDY

(Poultry Laying Flock Contractors)

A. Name(s) and address(es) for the contractor:

B. Description of the contracts:

1. Type - Verbal

Written

2. Length of time covered:

3. Items furnished by contractor:

a.

b.

c.

d.

4. Items furnished by contractees:

a.

b.

c.

d.

5. Terms of marketing and sharing of returns:

C. Number of contracts in force:

1. Presently _____

2. Peak time _____ Date _____

D. Does the contractor have recent knowledge of the actual number of laying hens on hand?

If Yes (), ask item E.

If No (), skip to item F.

E. No. of Laying hens:

1. Most recent count _____

2. Date of this count _____

3. Count obtained every _____

F. Does the contractor have recent knowledge of the number of eggs produced?

If Yes (), ask item G.

If No (), skip to item H.

G. No. of eggs laid per _____

1. Most recent count _____

2. Date of this count _____

3. Count obtained every _____

H. When were young pullets last placed in flocks? _____

1. Number placed _____

I. Does the contractor have recent knowledge of the actual death losses?

If Yes (), ask item J.

If No (), ask item K.

J. No. of deaths per _____

1. Most recent count _____

2. Date of this count _____

3. Counts obtained every _____

K. Where are the chickens actually located?
(County & State)

L. Is the term "Contractor" meaningful to the contractee?

M. Could a list of contractees and their addresses be obtained?

1. Yes No

2. Comments:

N. Of the contractees whose contracts expired during the past year, what percentage:

1. Signed a new contract with you _____

2. Signed with another contractor _____

3. Went out of poultry business _____

O. Comments:

Appendix C

Budget Bureau No. 40-568010
Approval Expires 6/30/68

UNITED STATES DEPARTMENT OF AGRICULTURE
Statistical Reporting Service
P. O. Drawer 580

Dear Sir:

The New Mexico Crop and Livestock Reporting Service is in the process of updating our livestock lists for the State. Your name has recently been added to our list. Since an out-of-state address has been given, we need some additional information concerning your New Mexico's holdings. The questions below relate only to your New Mexico land and livestock. Please answer the questions below and return it in the enclosed envelope which requires no postage. Your cooperation will be appreciated.

Sincerely,

Joe D. Herman
Agricultural Statistician
in Charge

1. Do you own any land in New Mexico? YES (), NO ()
2. Do you own or have part-interest in a livestock operation in New Mexico? YES (), NO ()
 - a. If yes, what is the place commonly called? _____
 - b. Person in charge of the livestock operations in New Mexico:

name _____

address _____

city _____
 - c. If you are involved in more than one livestock operation in New Mexico, please give additional farm or ranch names and local managers names on the back side of this paper.

3. Please comment on any special tenure arrangements such as partnerships you might have with your New Mexico land and/or livestock.

Appendix D

Multiple Frame Formulas

Estimates from the Area Sample

${}_1X_{hij}$ = value of variable ${}_1X$ for tract j , segment i , of stratum h .
(Non-overlap domain)

${}_2X_{hij}$ = value of variable ${}_2X$ for tract j , segment i , of stratum h .
(Overlap domain)

E_h = expansion factor for stratum h .

n_h = number of segments in sample in stratum h .

$\hat{X}_1 = \sum_h E_h \sum_i \sum_j {}_1X_{hij}$ = expanded total for variable ${}_1X$.

$\hat{X}_2 = \sum_h E_h \sum_i \sum_j {}_2X_{hij}$ = expanded total for variable ${}_2X$.

${}_1X_{hi\cdot}$ and ${}_2X_{hi\cdot}$ are the segment totals $\sum_j {}_1X_{hij}$ and $\sum_j {}_2X_{hij}$ for the two domains.

$$\text{Var } ({}_1\hat{X}) = \sum_h E_h^2 \left(\frac{n_h}{n_h-1} \right) \left[\sum_i ({}_1X_{hi\cdot})^2 - \frac{\left(\sum_i {}_1X_{hi\cdot} \right)^2}{n_h} \right]$$

$$\text{Var } ({}_2\hat{X}) = \sum_h E_h^2 \left(\frac{n_h}{n_h-1} \right) \left[\sum_i ({}_2X_{hi\cdot})^2 - \frac{\left(\sum_i {}_2X_{hi\cdot} \right)^2}{n_h} \right]$$

$$\text{Cov } ({}_1\hat{X}, {}_2\hat{X}) = \sum_h E_h^2 \left(\frac{n_h}{n_h-1} \right) \left[\sum_i ({}_1X_{hi\cdot}) ({}_2X_{hi\cdot}) - \frac{\left(\sum_i {}_1X_{hi\cdot} \right) \left(\sum_i {}_2X_{hi\cdot} \right)}{n_h} \right]$$

Estimates from the List Sample

M_h = number on the list in stratum h.

m_h = number in mailed sample for stratum h.

m_{1h} = number responding by mail in stratum h.

$m_{2h} = m_h - m_{1h}$ = number of non-respondents in stratum h.

r_h = number in non-response subsample in stratum h.

(r_h of the m_{2h} are selected for enumerating).

v_{hi} = mailed returns, value of variable y for operator i in stratum h, adjusted for within-list duplication. (observation ÷ number times on list)

v_{hi}^* = interview returns, value of variable y for operator i in stratum h, adjusted for within-list duplication.

$$\hat{Y}_h = \left(\frac{M_h}{m_h} \right) \left[\sum_{i=1}^{m_{1h}} v_{hi} + \left(\frac{m_{2h}}{r_h} \right) \sum_{i=1}^{r_h} v_{hi}^* \right] = \text{estimated total for stratum h.}$$

$$\text{Var } (Y_h) = \frac{M_h^2}{m_h(m_h-1)} \left[\frac{m_{2h}(m_{2h}-r_h)}{r_h(r_h-1)} \left\{ \sum_{i=1}^{r_h} (v_{hi}^*)^2 - \frac{\left(\sum_{i=1}^{r_h} v_{hi}^* \right)^2}{r_h} \right\} \right. \\ \left. + \frac{M_h - m_h}{m_h(m_h-1)} \left\{ \sum_{i=1}^{m_{1h}} v_{hi}^2 + \left(\frac{m_{2h}}{r_h} \right) \sum_{i=1}^{r_h} (v_{hi}^*)^2 \right\} - \left(\frac{M_h - m_h}{M_h} \right) \frac{\hat{Y}_h^2}{m_h-1} \right]$$

$$\hat{Y} = \sum_h \hat{Y}_h = \text{estimated total for the list universe.}$$

$$\text{Var } (\hat{Y}) = \sum_h \text{Var } (\hat{Y}_h) = \text{variance of estimated total for the list universe.}$$

Estimates from List Sample Where Mailing is to the Entire List

If the mailings are to the entire list and a subsample of the non-respondents are interviewed, then:

$$\hat{Y}_h = \sum_{i=1}^{M_{1h}} y_{hi} + \left(\frac{M_{2h}}{r_h} \right) \sum_{i=1}^{r_h} y_{hi}^*$$

$$\text{Var} (\hat{Y}_h) = M_{2h} \frac{(M_{2h} - r_h)}{r_h (r_h - 1)} \left\{ \sum_{i=1}^{r_h} (y_{hi}^*)^2 - \frac{\left(\sum_{i=1}^{r_h} y_{hi}^* \right)^2}{r_h} \right\}$$

since in this case $m_h = M_h$

$$m_{1h} = M_{1h}$$

$$m_{2h} = M_{2h}$$

Where:

$$\hat{Y} = \sum_h \hat{Y}_h$$

$$\text{Var} (\hat{Y}_h) = \sum_h \text{Var} (\hat{Y}_h)$$

Combining the Area and List Estimates

\hat{Z} = estimated total for the state

$$\hat{Z} = \hat{X}_1 + (p) \hat{X}_2 + (q) \hat{Y}$$

where $p + q = 1$

$$\text{Var} (\hat{Z}) = \text{Var} (\hat{X}_1) + p^2 \text{Var} (\hat{X}_2) + q^2 \text{Var} (\hat{Y}) + 2p \text{Cov} (\hat{X}_1, \hat{X}_2)$$

To estimate the completeness of the list:

$$\frac{\hat{Y}}{\hat{Z}} = \text{proportion covered by the list.}$$

$$\text{Var} \left(\frac{\hat{Y}}{\hat{Z}} \right) = \left(\frac{\hat{Y}^2}{\hat{Z}^2} \right) \left[\frac{\text{Var} (\hat{Y})}{(\hat{Y})^2} + \frac{\text{Var} (\hat{Z})}{(\hat{Z})^2} - \frac{2pq \text{Var} (\hat{Y})}{\hat{Y} \hat{Z}} \right]$$

where the q in the last term is from $\hat{Z} = p_1 \hat{X} + (p) p_2 \hat{X} + (q) \hat{Y}$

UNITED STATES DEPARTMENT OF AGRICULTURE
STATISTICAL REPORTING SERVICE

Budget Bureau No. 40-66105
Approval expires 12-31-66

CATTLE SURVEY, DECEMBER 1, 1966

SECTION I. LAND OPERATED AND TENURE ARRANGEMENTS

"In this section please describe your PRESENT farm or ranch operation. This should include any land you own, rent or manage for others regardless of county where located."

- 1. Do you own any land? Yes No
(If "No", skip to Question 3.)

- 2. How many acres do you own and in what county(s) is the land located?

(Acres)	(County)

- 3. Do you rent any land from others? Yes No
(Include land rented for cash or worked on shares.)
(If "No", skip to Question 5.)

- 4. List each person's name and address from whom you rent and the number of acres rented from each and county where located:

Name of Landlord	Address	Acres	County

- 5. Do you operate any land for others as a hired manager?... Yes No
(If "No", skip to Question 7.)

- 6. List the name and address of the person for whom you manage and record the acres managed and the county where located:

(Acres)	(County)
- Name _____
Mailing address _____

- 7. Do you rent any land to others?..... Yes No
(Include all land worked by others on shares. Do not include land in the soil bank or other Government programs.) (If "No", skip to Question 9.)

- 8. What is the name and address of each tenant? Record the acres rented to each tenant and county where located?

Name of Tenant	Address	Acres	County

- 9. Does anyone else operate land for you as a hired manager? Yes No
(If "No", skip to Question 11.)

10. What is the name and address of each manager? Record the acres managed by each manager and county where located:

Name of manager	(Acres)	(County)
Mailing address		

11. Do you operate any land in partnership with others?..... Yes No
(If "No", skip to Question 14.)

12. (A) If "Yes", what is the name and address of your partner(s)?

Name of partner
Mailing address

(B) How many acres are included in this partnership operation? _____ Acres

(C) Are these acres included in your answers to Questions 2, 4, and 6?..... Yes No
(If "Yes", skip to Question 14.)

13. If the answer to Question 12(C) is "No", record the total acres operated under this partnership.....

(Acres)	(County)

ACRES IN THIS PLACE

14. Then the total acres operated by you (including partnership operations) is:

(Questions 2 + 4 + 6 + 13 - 8 - 10)

(Acres)

(A) Are any or part of these acres operated under some name other than the one listed on the front of this questionnaire? (For example, if the name listed on the front is Sam Jones, but instead you operate the farm under the name of Spring Valley Farm)..... Yes No
(If "Yes", list other name(s) and acres associated with it.)

Name	Acres Operated

15. Do the total acres in Question 14 above correctly represent the size of your operations?..... Yes No
(If "No", please explain any differences.)

SECTION II. CATTLE

The following questions relate to cattle which are presently located on the total acres you operate (Question 14). Also, include cattle you own grazing on land under a government grazing permit. Include cattle on this farm regardless of ownership, but exclude any which you own that are on land operated by others.

16. How many CATTLE and CALVES are on this farm now? (Include new-born calves).....
17. How many are COWS and HEIFERS two years old and over? (Include dairy and beef cows).....
18. How many are HEIFERS and HEIFER CALVES under two years old?....
19. How many are BULLS and STEERS? (Include bull and steer calves.)
20. Are the cattle and calves in Question 16 all located in one county?..... Yes No
(If "No", give county and head per county.)

Number

County	Number

Reported by _____ Telephone Number _____

10. What is the name and address of each manager? Record the acres managed by each manager and county where located:

Name of manager	(Acres)	(County)
Mailing address		

11. Do you operate any land in partnership with others?..... Yes No
(If "No", skip to Question 14.)

12. (A) If "Yes", what is the name and address of your partner(s)?

Name of partner
Mailing address

(B) How many acres are included in this partnership operation? _____ Acres

(C) Are these acres included in your answers to Questions 2, 4, and 6?..... Yes No
(If "Yes", skip to Question 14.)

13. If the answer to Question 12(C) is "No", record the total acres operated under this partnership.....

(Acres)	(County)

ACRES IN THIS PLACE

14. Then the total acres operated by you (including partnership operations) is:

(Acres)

(Questions 2 + 4 + 6 + 13 - 8 - 10)

(A) Are any or part of these acres operated under some name other than the one listed on the front of this questionnaire? (For example, if the name listed on the front is Sam Jones, but instead you operate the farm under the name of Spring Valley Farm)..... Yes No
(If "Yes", list other name(s) and acres associated with it.)

Name	Acres Operated

15. Do the total acres in Question 14 above correctly represent the size of your operations?..... Yes No
(If "No", please explain any differences.)

SECTION II. CATTLE

The following questions relate to cattle which are presently located on the total acres you operate (Question 14). Also, include cattle you own grazing on land under a government grazing permit. Include cattle on this farm regardless of ownership, but exclude any which you own that are on land operated by others.

16. How many CATTLE and CALVES are on this farm now? (Include new-born calves.).....
17. How many are COWS and HEIFERS two years old and over? (Include dairy and beef cows.).....
18. How many are HEIFERS and HEIFER CALVES under two years old?....
19. How many are BULLS and STEERS? (Include bull and steer calves.).....
20. Are the cattle and calves in Question 16 all located in one county?..... Yes No
(If "No", give county and head per county.)

Number

County	Number

Reported by _____ Telephone Number _____

SHEEP SURVEY, DECEMBER 1, 1966

SECTION I. LAND OPERATED AND TENURE ARRANGEMENTS

"In this section please describe your PRESENT farm or ranch operation. This should include any land you own, rent or manage for others regardless of county where located."

- 1. Do you own any land? Yes No
(If "No", skip to Question 3.)

- 2. How many acres do you own and in what county(s) is the land located?

(Acres)	(County)

- 3. Do you rent any land from others? Yes No
(Include land rented for cash or worked on shares.)
(If "No", skip to Question 5.)

- 4. List each person's name and address from whom you rent and the number of acres rented from each and county where located:

Name of Landlord	Address	Acres	County

- 5. Do you operate any land for others as a hired manager?... Yes No
(If "No", skip to Question 7.)

- 6. List the name and address of the person for whom you manage and record the acres managed and the county where located:

Name _____
Mailing address _____

(Acres)	(County)

- 7. Do you rent any land to others?..... Yes No
(Include all land worked by others on shares. Do not include land in the soil bank or other Government programs.) (If "No", skip to Question 9.)

- 8. What is the name and address of each tenant? Record the acres rented to each tenant and county where located?

Name of Tenant	Address	Acres	County

- 9. Does anyone else operate land for you as a hired manager? Yes No
(If "No", skip to Question 11.)

10. What is the name and address of each manager? Record the acres managed by each manager and county where located:

Name of manager	(Acres)	(County)
Mailing address		

11. Do you operate any land in partnership with others?..... Yes No
(If "No", skip to Question 14.)

12. (A) If "Yes", what is the name and address of your partner(s)?

Name of partner
Mailing Address

(B) How many acres are included in this partnership operation? _____ Acres

(C) Are these acres included in your answers to Questions 2, 4, and 6?..... Yes No
(If "Yes", skip to Question 14.)

13. If the answer to Question 12(C) is "No", record the total acres operated under this partnership.....

(Acres)	(County)

ACRES IN THIS PLACE

14. Then the total acres operated by you (including partnership operations) is:
(Questions 2 + 4 + 6 + 13 - 8 - 10)

(Acres)

(A) Are any or part of these acres operated under some name other than the one listed on the front of this questionnaire? (For example, if the name listed on the front is Sam Jones, but instead you operate the farm under the name of Spring Valley Farm)..... Yes No
(If "Yes", list other name(s) and acres associated with it.)

Name	Acres Operated

15. Do the total acres in Question 14 above correctly represent the size of your operations?..... Yes No
(If "No", please explain any differences.)

SECTION II. SHEEP

The following questions relate to sheep which are presently located on the total acres you operate (Question 14). Also, include sheep that you own grazing on land under a government grazing permit. Include sheep on this farm regardless of ownership, but exclude any which you own that are on land operated by others.

16. How many SHEEP and LAMBS of all ages are on this farm now? (Include Ewes, Rams, Wethers, and Lambs.).....

Number

17. How many are breeding ewes over one year old?.....

18. Are the SHEEP and LAMBS in Question 16 all located in one county?..... Yes No
(If "No", give county and head per county.)

County	Number

Reported by _____ Telephone Number _____

CHICKEN SURVEY, DECEMBER 1, 1966

SECTION I. LAND OPERATED AND TENURE ARRANGEMENTS

"In this section please describe your PRESENT farm or ranch operation. This should include any land you own, rent or manage for others regardless of county where located."

- 1. Do you own any land? Yes No
(If "No", skip to Question 3.)

- 2. How many acres do you own and in what county(s) is the land located?

(Acres)	(County)

- 3. Do you rent any land from others? Yes No
(Include land rented for cash or worked on shares.)
(If "No", skip to Question 5.)

- 4. List each person's name and address from whom you rent and the number of acres rented from each and county where located:

Name of Landlord	Address	Acres	County

- 5. Do you operate any land for others as a hired manager?... Yes No
(If "No", skip to Question 7.)

- 6. List the name and address of the person for whom you manage and record the acres managed and the county where located:

Name _____
Mailing address _____

(Acres)	(County)

- 7. Do you rent any land to others?..... Yes No
(Include all land worked by others on shares. Do not include land in the soil bank or other Government programs.) (If "No", skip to Question 9.)

- 8. What is the name and address of each tenant? Record the acres rented to each tenant and county where located?

Name of Tenant	Address	Acres	County

- 9. Does anyone else operate land for you as a hired manager? Yes No
(If "No", skip to Question 11.)

10. What is the name and address of each manager? Record the acres managed by each manager and county where located:

Name of manager	(Acres)	(County)
Mailing address		

11. Do you operate any land in partnership with others?..... Yes No
(If "No", skip to Question 14.)

12. (A) If "Yes", what is the name and address of your partner(s)?

Name of partner
Mailing address

(B) How many acres are included in this partnership operation? _____ Acres

(C) Are these acres included in your answers to Questions 2, 4, and 6?..... Yes No
(If "Yes", skip to Question 14.)

13. If the answer to Question 12(C) is "No", record the total acres operated under this partnership.....

(Acres)	(County)

ACRES IN THIS PLACE

14. Then the total acres operated by you (including partnership operations) is:
(Questions 2 + 4 + 6 + 13 = 8 + 10)

(Acres)

(A) Are any or part of these acres operated under some name other than the one listed on the front of this questionnaire? (For example, if the name listed on the front is Sam Jones, but instead you operate the farm under the name of Spring Valley Farm)..... Yes No
(If "Yes", list other name(s) and acres associated with it.)

Name	Acres Operated

15. Do the total acres in Question 14 above correctly represent the size of your operations?..... Yes No
(If "No", please explain any differences.)

SECTION II. CHICKENS

The following questions relate to chickens which are presently located on the total acres you operate (Question 14.) Include chickens on this farm regardless of ownership, but exclude any which you own that are on land operated by others.

16. How many chickens of all ages (excluding commercial broilers) were on this farm yesterday?.....
17. Of these chickens (Question 16) how many were:
- a. Hens and pullets of laying age?.....
 - (1) Of the hens and pullets (Question 17a) how many were one year old and over?.....
 - b. Pullets not yet of laying age but 3 months old and over?.....
 - c. Pullet chicks and pullets under 3 months old (excluding commercial broilers)?.....
 - d. Other chickens (excluding commercial broilers but including male breeding stock and male chickens?).....

Number

18. How many eggs were produced by your flock yesterday?.....

19. Are the CHICKENS in Question 16 all located in one county?..... Yes No
(If "No", give county and head per county.)

County	Number

Reported by _____ Telephone Number _____

UNITED STATES DEPARTMENT OF AGRICULTURE
STATISTICAL REPORTING SERVICE

Budget Bureau No. 10-S670L2
Approval Expires 8-31-67

L

1967 JUNE PROBABILITY MAIL SURVEY

Dear Sir:

For over a century the Statistical Reporting Service has issued current information on the nation's farm production. These reports are used by farmers and others in planning their operations.

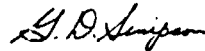
This office is now conducting a study to find more accurate and economical estimating methods.

Please take a few minutes to fill out this inquiry. The information you provide will be held confidential and will be used only for statistical purposes in combination with other reports.

Please return the completed questionnaire in the enclosed envelope which requires no stamp.

Thank you for your cooperation.

Respectfully,



G.D. Simpson, Chairman
Crop Reporting Board

SECTION I. LAND OPERATED AND TENURE ARRANGEMENTS

* In this section please describe your PRESENT farm or ranch operation. This should include any land you own, rent or manage for others regardless of county where located. If a question does not apply to your operation please record a zero for that question.

1. How many acres do you (name on front of questionnaire) own and in what county(s) is the land located? (Include cropland, pastureland, feedlots, wasteland, and non-agricultural land regardless of location)

(County)	Acres

2. How many acres do you RENT FROM OTHERS for cash, standing rent or for a share of the crop? (Include Federal, State or private land rented or leased on a per acre basis)

Acres

a. What is the name and address of each person, the number of acres rented from each and the county(s) where the land is located?

Name	Acres	Name	Acres
Street or RFD	County	Street or RFD	County
City & State		City & State	

3. How many acres of land do you OPERATE FOR OTHERS as a hired manager (responsible for day to day control of land and making most of the management decisions)?

Acres

a. What is the name and address of each person, the number of acres managed and the county(s) where the land is located?

Name	Acres	Name	Acres
Street or RFD	County	Street or RFD	County
City & State		City & State	

4. How many acres do you OPERATE IN PARTNERSHIP WITH SOMEONE ELSE?

Acres

a. What is the name and address of each partner, the total acreage in each partnership and the county(s) where the land is located?

Name	Acres	Name	Acres
Street or RFD	County	Street or RFD	County
City & State		City & State	

b. How many of the partnership acres (question 4) are already included in your answers to questions 1, 2 and 3?

Acres

5. Totals

a. Total acres listed on lines 1, 2, 3 and 4?

Acres

b. Acres listed on line 4 b

Acres

c. Subtotal (5 a minus 5 b)

Acres

6. How many acres of land do you RENT TO OTHERS? (Include land worked by others on shares or cash rent or managed by someone for you. Do not include land in the soil bank or other government programs.)

Acres

a. What is the name and address of each tenant, manager, or sharecropper, the number of acres and the county(s) where the land is located.

Name	Acres	Name	Acres
Street or RFD	County	Street or RFD	County
City & State		City & State	

7. TOTAL ACRES IN YOUR OPERATION

Acres

a. Line 5 c minus line 6

b. Does the total acres listed in question 7 a above correctly represent the size of your operation?

Yes No

(If "NO" please explain any differences on page 4)

(If question 7 is "NONE" skip to Question 25)

SECTION II. LIVESTOCK AND POULTRY

The following livestock and poultry questions relate to your operation as indicated in Question 7 above. Include all cattle, hogs, sheep and chickens on these acres regardless of ownership. However, exclude any livestock that you now own but which are presently on privately owned land not included in Question 7 above.

HOGS AND PIGS

6. How many hogs and pigs of all ages are on these (Item 7) acres now, including sows, gilts, boars, feeder pigs and all other hogs and pigs?..... Number

CATTLE AND CALVES

9. How many cattle and calves of all ages are on these (Item 7) acres now, including all milk cows, beef cows, heifers, steers, bulls and this year's calves still on hand? (If "NONE" skip to question 11).

10. Of these (Item 9) cattle and calves, how many are: (a) Cows and heifers 2 years old and older?..... (b) Heifers and heifer calves under 2 years old?..... (c) Bulls and steers, including bull and steer calves?.....

/Check: Item 10 a + 10 b + 10 c must equal Item 9./

11. How many calves were born on these (Item 7) acres since January 1, 1967? Include calves already sold, butchered or died..... 12. Of the cows and heifers on these (Item 7) acres now, how many do you expect will have calves from now thru December 31, 1967?..... 13. How many milk cows, both dry and in milk, are on these (Item 7) acres? DO NOT INCLUDE HEIFERS THAT HAVE NOT FRESHENED.....

SHEEP AND LAMBS

14. How many sheep and lambs of all ages are on these (Item 7) acres now, including ewes, rams, wethers and lambs?.....

CHICKENS

15. How many chickens of all ages are on these (Item 7) acres now, including hens and pullets of laying age, roosters, pullets not of laying age, cockerels, male chicks and young chicks being raised for laying flock replacement?..... DO NOT INCLUDE COMMERCIAL BROILERS.

(If Question 15 is "NONE" skip to Question 18)

16. Of these (Item 15) chickens, how many are hens and pullets of laying age?.....

17. How many eggs were produced by these (Item 16) layers yesterday?..

18. During last month how many hens and pullets of laying age on these (Item 7) acres were:

(a) Culled from your flock (sold or eaten)?..... (b) Lost from disease, accident, exposure, etc.?.....

19. During last month how many pullets were added to your laying flock on these (Item 7) acres?.....

20. How many chicks and young chickens, including all pullets, and male breeding stock, hatched since January 1, 1967, are on these (Item 7) acres now?.....

21. Of these (Item 20) chicks and young chickens, how many are pullets and pullet chicks?..... (Include started pullets)

22. How many chickens, hatched since January 1, 1967 have been eaten or sold for slaughter from the (Item 7) acres?.....

23. Are any of these chickens being raised under contract?
Yes No If YES, how many?.....

(Do not include commercial broilers)

(a) What is the name and address of each contractor?

Name	Number of Birds	Name	Number of Birds
Street or RFD		Street or RFD	
City & State		City & State	

24. Does anyone else have livestock or poultry on the (Item 7) acres operated by you which were not included in the answers to questions 8-23?

If No , skip to Item 25.

If Yes , correct Items 8-23 as required.

25. (a) Reported by _____

(b) Date _____ Telephone Number _____

(c) Name of Farm or Ranch _____

(d) Other names Farm or Ranch is known by _____

Please use the notes section on this page if you have any questions, unusual tenure arrangements, change in mailing address, etc.

NOTES:

UNITED STATES DEPARTMENT OF AGRICULTURE
STATISTICAL REPORTING SERVICE

Budget Bureau No. 40-S67042
Approval Expires 8-31-67

B

1967 JUNE PROBABILITY MAIL SURVEY

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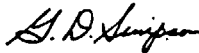
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G.D. Simpson, Chairman
Crop Reporting Board