OPTIMIZING THE USE OF LIST AND AREA SAMPLES IN LIVESTOCK MULTIPLE FRAME SURVEYS

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Washington, D. C.

September 1975

SF 75-03

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INTRODUCTION

This report examines the problem of determining the optimum mix of area and list sampling frames used in livestock multiple frame surveys. The analysis provides the basis for specific recommendations about sampling the list frame for livestock multiple frame surveys.

Although the sampling design is obviously not independent of the definitions and methods used in construction of the list sampling frames, these analyses relate exclusively to matters of sample design and maximizing sampling efficiency. Even though a "complete list" is obtained, it is still necessary to ask what kind and how large a sample is needed to maximize the sampling efficiency with a minimum of costs.

The livestock multiple frame program has expanded since its inception and the agency has supported and encouraged a philosophy of large list samples. Because the problem is now examined from a broader point of view than sampling errors and enumeration cost per unit, some conclusions are reached that differ from conclusions based on earlier research. Enough data are now available to provide a critical review of the current procedures. Hopefully, everyone evaluates the results to be presented with one goal in mind: To develop sampling procedures to provide the best possible estimates with the most efficient use of survey resources.

The work began with a thorough analysis of the June 1973 Area and Multiple Frame Surveys in Nebraska. 1/ The results of this study were so revealing that a similar analysis of June 1973 data was conducted in seven additional states. 2/

The conclusions of these two studies were that:

a. The area frame will provide an estimate for operations currently estimated by the "zero and size unknown" strata in the list frame with little or no loss in sampling efficiency.

b. Little loss in sampling efficiency occurs even if the area frame also estimates for small livestock operations.

The implications of this analysis were such that it was continued for another year. At the request of the Sample Survey Research Branch, a special code box was printed on the face page of the 1974 June Enumerative Survey, Part A questionnaires. The completion of the code boxes was voluntary - yet 12 states did the necessary coding. We are indebted to these states since the coded questionnaires permitted the continuation of the analysis.

1/ Analysis of 1973 Nebraska June Enumerative Survey and Multiple Frame Survey Livestock Estimates, Research Division, March 1974.

2/ Multiple Frame Livestock Surveys, A Comparison of Area and List Sampling, Research Division, May 1974.

The analysis of the 1974 data was completed in the same manner as that used for 1973. However, to avoid any misunderstandings about the analysis the procedures are described in greater detail in this report than in the previous reports.

The analysis section contains a detailed discussion of the factors affecting the estimates and sampling errors for the list and area sampling frames.

BACKGROUND

The livestock multiple frame program began in 1968 with four states. An additional state entered the program in 1969. The methodology used in these states was the result of several research projects conducted throughout the 1960's. In 1962, H. O. Hartley developed the theory and the estimators used for multiple frame surveys. Texas A&M University and Iowa State University have continued research on multiple frame methodology with the primary emphasis on the improvement of Hartley's estimator. Little of their research involved survey problems, data collection problems, or sampling procedures. However, they stated a need for determining an optimum allocation between the area and list sampling frames.

During this time, SRS also conducted several research projects to evaluate alternative list sources for livestock multiple frame surveys. 3/ Pilot studies were conducted to compare ASCS lists and tax assessor lists with other list sources and to develop survey procedures. None of this early research involved a thorough analysis of how complete a list frame should be. However, a research report 4/ contains the following statement: "The variance of the multiple frame estimator can be reduced by using a more complete list." While this research project was based on one or two crop reporting districts in each of four states, the statement that sampling errors can be reduced by using a more complete list was based on analysis assuming hypothetical values in one crop reporting district in Tennessee. No analysis of operational survey data was completed to determine an optimum allocation between list and area frames based on variances, unit costs and available resources. Not fully anticipated at that time was the difficulty in developing complete list frames with sufficient data for stratification.

3/ An Evaluation Of The ANH Lists In Wyoming As A Sampling Frame For Estimating Livestock Inventories, Research and Development Branch, Research Division, July 1970.
1965 Mississippi Multiple Frame Study, Research and Development Branch, Research Division, January 1966.

4/ Four State Multiple Frame Study, Table 5.10, March 1966-June 1968, Research and Development Branch, Research Division, December 1969.

From the consideration of only variances grew the philosophy that the list frame should contain 90 percent of the item of interest. Thus, regardless of the number of farms and the distribution of livestock, states were encouraged to create as complete a list as possible. This procedure was often followed even if a large portion of the farms in a state had no livestock or only small numbers of livestock.

The first five states to enter the livestock multiple frame program had good list frames. They were based on annual state farm censuses or tax assessor rolls. Satisfactory data were available for stratification. Virtually every name on the lists had some sort of information for stratification purposes. They did not have strata defined to be "size unknown." The philosophy that a complete list should be used was applicable to the states where a large portion of all farm operators had either hogs, cattle or both.

By June 1973, there were 29 states in the livestock multiple frame program. With few exceptions, these states had large list frames. That is, their list frames contained nearly as many names as there were farms in the state. In some cases, lists contained more names than the estimated number of farms for the state. In general, the completeness of the list frames was given priority over the quality. As a result, many states had lists with a large portion of the names in strata defined to be "size group unknown." The main item of information required for a sampling unit was whether or not it had the specie of interest. Large portions of the list frames in these states did not have this information. Therefore, an important advantage of using the list frame as a sampling tool was lost.

Table 1 summarizes the status of the list frames currently used in 1974 in the cattle multiple frame program in the 12 states included in the analysis to follow. These 12 states represent a cross section of all states in the livestock multiple frame program.

Note that 63 percent of the total names on the list frames in these states are in the zero, size unknown, or small livestock strata. These names only account for 19 percent of the total cattle inventory. Yet, 37 percent of the total list sample comes from these strata.

Table 1 --List frame composition for 12* states in the Multiple Frame Survey Program, June 1974

Total number of farms	976,000
Total number of names on list frames	838,000
Percent of cattle inventory estimated by list frame	84
Number of names in 0, size unknown, and small livestock strata	526,000
Percent of total names	63
Percent of total cattle inventory	19
Number of names in list frame sample	22,500
Number of names from 0, size unknown, and small livestock strata	8,300
Percent of total sample	37

* ALA, ARK, COLO, FLA, IDAHO, IND, KY, MISS, NEBR, N Y, OKLA, TEX

SUMMARY PROCEDURES

The purpose of this analysis is to evaluate alternative multiple frame estimates and their sampling errors that would have resulted if only a portion of the list frame had been used. The analysis was possible because tract data were collected for every tract in the JES sample, both overlap and nonoverlap tracts. Further, every overlap tract in 12 states was coded to identify which list stratum contained the name causing it to be overlap. If that list stratum had not been sampled, then all tracts it caused to become overlap would have been nonoverlap. The basic procedure used in the analysis was to remove strata one at a time from the list frame in each state. If each stratum was no longer sampled from the list frame, then the list coverage of the population would become smaller and the area frame would absorb it in the nonoverlap domain. This procedure was followed in each selected state by deleting strata one at a time starting with the "unknown," then the zero stratum, followed by the livestock strata and letting the nonoverlap domain become larger. Whenever a stratum was not included in the list sample, the nonoverlap domain increased because tracts that were overlap with that stratum became nonoverlap. As each additional list stratum was removed from the sample, a new multiple frame estimate was computed using the remaining list sample and the larger nonoverlap domain. The process continued until the only list strata remaining were the extreme operator strata which in conjunction with the area frame results in the "tract" or "closed segment" estimate as it is commonly known. This allowed an evaluation of the resulting estimate as the area frame accounted for a larger portion of the universe and the list frame became smaller. The Appendix contains a more detailed and technical description of the methodology used in the analysis.

However, we wish to stress that the analysis was completed using all survey data from both sampling frames. The results were based on the complete list sample and the entire portion of the area frame used for the original nonoverlap estimate. This was 80 percent of the frame in all states except Florida (20 percent), Arkansas, and Texas which used 100 percent of the frame. The analysis was not based on small sample sizes usually associated with research projects. The estimates and their sampling errors obtained from each combination of the list strata and area frame were those that would have resulted had a portion of the list data been omitted.

The most important consideration in this analysis is the comparison of the estimates and their sampling errors. A second point is how a change in list coverage affects the level of the estimate. Another consideration is how the size of the universe and the sample sizes change as smaller portions of the list frame are used. Every sound survey design must take into consideration frame development costs and survey costs. This involves deciding whether a small decrease in sampling errors arising from using a large portion of a list is worth the extra data collection

cost involved. This report will not get into a cost analysis; however, this has been done and is described in "Analysis of 1973 Nebraska June Enumerative Survey and Multiple Frame Survey Livestock Estimates."

Complete tables of direct expansions, sampling errors and sample sizes for each state involved in this analysis are in the Appendix. The results are also illustrated graphically in the Appendix. The graphs provide the necessary information to answer each question raised above. The Appendix also contains a description of the list strata in each state.

Although the primary consideration in the multiple frame sampling methodology was to improve the quality of state estimates, the effect on regional estimates if changing the sampling procedure at the state level must be evaluated. Therefore, tables and graphs also illustrate what happens to the combined 12 state estimates as fewer strata are sampled from the list frames and the area frame nonoverlap estimate becomes larger. Since every state has a different set of stratification variables, the information shown at the combined state level is not at the depth shown for the individual states. Therefore, the following estimators are compared in Table 2 for cattle and Table 3 for hogs. Estimator I is the original multiple frame estimate for these states. Estimator II (Modified A) is that obtained when the strata consisting of *zero livestock* and *livestock size unknown* operators are not sampled from the list frame and estimated by the nonoverlap domain. Estimator III (Modified B) is obtained by *not sampling the zero livestock, livestock size unknown,* and *small livestock strata* in the list frame and letting the area frame nonoverlap domain estimate for them. Estimator IV is the area frame tract estimator for these 12 states which is the area frame plus extreme operators.

Again, only the same portion of the area frame used for the multiple frame survey was used to keep the four alternate estimates on the same basis as far as sampling frames are concerned. The nonoverlap estimate for all estimators was computed using closed segment expansions except in Idaho and Colorado where the farm expansion was used to include livestock on public grazing lands. Similar estimates were computed for the four states in the hog multiple frame survey program that were included in this analysis.

DISCUSSION OF THE RESULTS

Eight of the 12 cattle multiple frame states either showed no increase or actually a decrease in relative sampling errors when the zero and size unknown strata were not sampled from the list frame. Furthermore, these states showed very little change in sampling errors when the small livestock stratum was also not sampled from the list. Only four states (Idaho, Mississippi, Nebraska, and Oklahoma) show appreciable level differences for cattle as the zero and unknown strata are dropped from

Table 2 — A comparison of current multiple frame estimates, CV's and list population and sample sizes with those resulting from sampling a smaller portion of the list frame, Cattle Multiple Frame Survey, June 1974

STATE	CURRENT MULTIPLE FRAME (I)		MULTIPLE FRAME MODIFIED A (II)		MULTIPLE FRAME MODIFIED B (III)		E O's ONLY and AREA FRAME (IV)	
	DE	CV	DE	CV	DE	CV	DE	CV
	000	%	000	%	000	%	000	%
ALA	2921.4	4.3	2934.9	4.3	2895.7	4.7	2773.5	7.7
ARK	2842.1	3.7	2842.3	3.5	2849.0	4.2	3021.2	6.4
COLO	3818.7	4.0	3769.6	4.5	3757.9	5.1	3860.4	8.8
FLA	3184.1	4.7	3184.1	4.7	3239.9	5.3	2927.9	7.1
IDAHO	2609.7	4.3	2534.9	4.4	2509.9	5.0	2211.6	9.4
IND	2178.7	4.9	2072.8	7.2	2042.4	7.8	2070.0	10.6
KY	4188.9	3.6	4001.1	3.6	3892.1	3.6	3615.4	6.5
MISS	2976.5	4.5	3109.7	5.0	3713.9	6.0	3637.0	6.8
NEBR	7660.2	3.0	7891.1	3.0	8120.3	3.3	8597.0	4.8
NY	1917.8	2.2	1906.0	2.2	1900.5	2.3	2314.3	8.8
OKLA	8095.1	3.1	7945.4	3.0	7578.9	3.2	6775.3	3.8
TEX	18622.8	3.1	18834.5	2.9	18317.3	2.9	18976.5	3.4
TOTAL	61011.0	1.28	61026.4	1.23	60817.8	1.31	60780.1	1.75

STATE	CURRENT LIST FRAME		MODIFIED A LIST FRAME		MODIFIED B LIST FRAME		E O LIST FRAME	
	N	n	N	n	N	n	N	n
ALA	28,333	1,544	28,065	1,529	10,035	1,022	421	210
ARK	68,783	1,882	42,450	1.619	24,272	1,289	207	113
COLO	19,547	1,522	13,313	1,370	7,580	913	698	367
FLA	6,069	1,511	6,069	1,511	2,534	1,149	359	275
IDAHO	18,326	1,347	14,830	1,250	7,092	977	353	221
IND	83,121	1,667	37,942	901	13,731	563	204	72
KY	120,944	1,863	105,380	1,595	54,738	1,260	258	88
MISS	96,296	1,568	46,458	1,028	4,110	286	210	78
NEBR	60,084	1,366	47,048	1,182	22,909	847	175	81
BY	32,112	1,715	31,022	1,682	23,114	1,453	181	83
OK	94,921	1,692	74,479	1,500	28,421	1,043	641	198
TEX	208,230	3,161	75,541	1,633	21,134	1,209	600	344
TOTAL	836,766	20,838	522,597	16,800	219,670	12,011	4305	2130

Table 3 — A comparison of current multiple frame estimates, CV's, and list population and sample sizes with those resulting from sampling a smaller portion of the list frame, Hog and Pig Multiple Frame Survey, June 1974

STATE	CURRENT MULTIPLE FRAME (I)		MULTIPLE FRAME MODIFIED A (II)		MULTIPLE FRAME MODIFIED B (III)		E O 's ONLY and AREA FRAME (IV)	
	DE	CV	DE	CV	DE	CV	DE	CV
	000	%	000	%	000	%	000	%
IND	3531.5	6.4	3315.9	6.8	3291.5	9.4	4003.0	12.3
KY	1299.9	8.4	1300.1	8.5	1195.5	8.5	1301.1	13.7
NEBR	3409.1	6.0	3531.1	6.0	3646.5	6.9	3540.6	10.0
TEX	912.9	6.8	840.5	7.2	820.0	7.4	721.1	8.3
TOTAL	9153.4	3.6	8988.1	3.8	8953.4	4.6	9565.8	6.2

STATE	CURRENT LIST FRAME		MODIFIED A LIST FRAME		MODIFIED B LIST FRAME		E O LIST FRAME	
	N	n	N	n	N	n	N	n
IND	83,158	1,601	24,844	804	6,740	395	344	90
KY	120,944	1,865	106,105	1,577	15,378	782	415	121
NEBR	60,084	1,636	24,814	1,141	11,445	759	603	158
TEX	208,226	2,169	9,345	332	2,458	246	288	104
TOTAL	472,412	7,271	165,108	3,854	36,021	2,182	1,650	473

the list frame. The resulting multiple frame estimate does move toward the JES estimate in each case however. The graph in the Appendix and the Total lines in Tables 2 and 3 depicting the estimates at the combined state level shows that they change very little if the zero and unknown strata are not sampled from the list. Sampling errors are also not affected. In fact, for cattle the Modified B estimate results in a CV only slightly larger than that resulting from using the entire list.

Table 4 summarizes an interpretation of what effect an optimum cutoff would have in each state. This summarizes the sampling errors and sample sizes for the cutoff shown on the graph in the Appendix for each state. Factors considered in determining the list cutoff point were:

a) sampling errors
b) list sample sizes and resulting change in data collection costs
c) characteristics of strata considered for deletion - if a stratum consisted of livestock operations with 100 or more head, it was not considered for deletion regardless of the above two factors.

It is important to weigh any increase in the sampling error with the decrease in sample size that occurs. One must determine if the data collection cost is warranted for obtaining the decrease in sampling error from using a larger portion of the list.

The selected cutoff results in a sample that is smaller than that actually used by a total of 11,270 names for the 12 cattle surveys and the 4 hog surveys. The question that should be considered was: Did the extra cost provide a worthwhile gain in precision? It is important to remember that the entire area frame sample is enumerated during the JES. This data is available, virtually at no cost, for the multiple frame livestock program.

To reiterate a previous statement, the initial goal of multiple frame sampling was to obtain estimates with smaller CV's than was possible with current sample sizes for the area frame. The assumption was that to achieve this the list frame must be as complete as possible to reduce the use of the so-called less efficient area frame. However, this assumption carries with it the unstated condition that the resulting list frame will have to be more efficient than the area frame. In several states, sampling errors change very little even though large portions of the list are dropped. Why do the sampling errors not increase rapidly as certain strata are not sampled from the list? In fact, why do the sampling errors actually decrease in some instances? In brief, the list frames were not constructed to be more efficient. The following paragraphs attempt to elaborate on how this may have happened.

A factor not fully understood about the area frame is that it is inefficient only for large operations which also become rare items when compared to the total universe. The area frame is efficient for the smaller operations, especially when they are large in number.

Table 4 --A comparison of modified multiple frame list and sample sizes and CV's with the entire list frame sample, June 1974 survey data

State	Current Multiple Frame				Modified Multiple Frame			
	List Frame		DE	CV	List Frame		DE	CV
	N	n	(000)	(%)	N	n	(000)	(%)
ALA	28,333	1,544	2,921.4	4.3	10,035	1,022	2,895.7	4.7
ARK	68,783	1,882	2,842.1	3.7	24,272	1,289	2,849.0	4.2
COLO	19,547	1,522	3,813.7	4.0	7,580	913	3,757.9	5.1
FLA	6,069	1,511	3,184.1	4.7	2,534	1,149	3,239.9	5.3
IDAHO	18,326	1,347	2,609.7	4.3	7,092	977	2,509.9	5.0
IND	83,121	1,667	2,178.7	4.9	83,121	1,667	2,178.7	4.9
KY	120,944	1,863	4,188.9	3.6	54,738	1,260	3,892.1	3.6
MISS	96,296	1,568	2,976.5	4.5	46,458	1.028	3,109.7	5.0
NEBR	60,084	1,366	7,660.2	3.0	22,909	847	8,120.3	3.3
NY	32,112	1,715	1,917.8	2.2	23,114	1,453	1,900.5	2.3
OKLA	94,921	1,692	8,095.1	3.1	28,421	1,043	7,578.9	3.2
TEX	208,230	3,161	18,622.8	3.1	21,134	1,209	18,317.3	2.9
TOTAL	836,766	20,838	61,011.0	1.28	331,408	13,866	60,349.9	1.26
				(Hogs and Pigs)				
IND	83,158	1,601	3,531.5	6.4	24,844	804	3,315.9	6.8
KY	120,944	1,865	1,299.9	8.4	15,378	782	1,195.5	8.5
NEBR	60,084	1,636	3,409.1	6.0	24,814	1,141	3,531.1	6.0
TEX	208,226	2,169	912.9	6.8	2,458	246	820.0	7.4
TOTAL	472,412	7,271	9,153.4	3.6	67,494	2,973	8,862.5	4.4

The analysis presented above has shown that the area frame sometimes provides a better estimate for certain types of operations than does the list. This occurs even though the list sample usually has a smaller expansion factor because the variance of a sample estimate is not dependent on the size of the expansion factors when the sampling fractions are small. To illustrate these items data from the Texas area and list frames are used. For example, in Texas the area frame estimate for cattle for the "unknown" livestock stratum had a smaller CV than did the estimate from the list even though the list had a smaller expansion factor. The same was true of the "zero" livestock stratum. When tracts overlapping these two strata were added to the nonoverlap domain, the resulting CV of the multiple frame estimate went from 3.1 percent to 2.9 percent. Several reasons for this occurrence follow.

The sample size from these two strata was 1,582 names. The Texas area frame had 1,320 tracts with operators overlapping the same strata. The 1,320 tracts were clustered into the 848 segments for the variance computation. The point is that the area frame also has a large sample of these operations.

The "unknown" livestock can be considered only an extension of the nonoverlap domain which consists of operators who are also unknown as to type and size of operation. The "zero" livestock stratum by definition consists of mostly zero or small operators - again a characteristic of the nonoverlap domain. The inclusion of these operations in the nonoverlap domain greatly increases the efficiency of the nonoverlap estimate because it becomes less of a rare item.

How the efficiency of the area frame is affected by the frequency of occurrence is not easily understood. To explain this phenomenon, we rely in part on an explanation furnished by Kish (Survey Sampling, pp. 434-435).

a. In domain estimation, we have n sample units selected out of N.

b. Each sample unit falling in the nonoverlap domain has the value (number of cattle) Y_i. If it does not belong to the domain its value is zero.

c. Out of the n segments, m segments contain tracts in the nonoverlap domain. If we knew the total number of segments in the nonoverlap domain, the direct expansion would be

$$\frac{M}{m} \Sigma Y_i \text{ with variance } \frac{M^2}{m}(1 - F) \quad \frac{(\Sigma Y_i^2 - (\Sigma Y_i)^2/m)}{m - 1}$$

which is computed only around those units in the domain. However, M must be known. Since we do not know M in our case, we compute the direct expansion using $\frac{N}{n} \Sigma Y_i$ with variance

$$(1 - f) \frac{N^2}{n} \quad \frac{(\Sigma Y_i^2 - (\Sigma Y_i)^2/n)}{n - 1} .$$ Note that this is computed

around all sample segments in the sample. This allows us to

quantify the effect of estimating for relatively rare items using the following expression:

$$\Sigma Y_i^2 - \frac{(\Sigma Y_i)^2}{n} = (\Sigma Y_i^2 - \frac{(\Sigma Y_i)^2}{m}) + (\frac{(\Sigma Y_i)^2}{m} - \frac{(\Sigma Y_i)^2}{n})$$

$$= n\,Fm\,(V_Y^2 + (1 - Fm)\,\bar{Y}^2) \quad \text{where } Fm = \frac{m}{n} \text{ and } \bar{Y} = \frac{\Sigma Y_i}{m}\ .$$

Thus, when $\frac{N}{n}$ is used instead of $\frac{M}{m}$, the unit variance is increased by the factor $(1 - Fm)\,\bar{Y}^2$. As m gets closer to n, this effect is diminished. Therefore, as the nonoverlap domain becomes larger, m becomes closer to n.

d. In Texas, cattle are not a rare item and the number of people in the unknown and zero strata comprise about two-thirds of the names on the list which means they are not a rare item in the area frame. In Texas, the land use and geographic stratification tend to group like-size farms as far as type of farms and total acres. Therefore, the variance between segment totals tends to be about the same as the variance between list units. The effect of adding the unknown and zero operations to the nonoverlap domain does little to alter the differences between segment totals within land use strata. However, it greatly reduces the effect of $(1 - Fm)\,\bar{Y}^2$ because $(1 - Fm)$ approaches zero. The increased efficiency of the nonoverlap domain therefore improves the efficiency of the entire multiple frame estimate.

e. The use of the weighted and tract expansions seldom assigns an entire operation to one segment. Large operations are broken into smaller pieces that minimize their effect on the sampling errors.

The above illustrates that if m is made very small and the variance of the survey item in the nonoverlap domain is not reduced by a similar amount, the variance of the estimated total for that item will increase. The distribution of the population being sampled and the frequency of its occurrence in the sample must also be considered. Stratification in the list frame is really just an attempt to make $m = n$ where m is the number of sampled names that actually have cattle. If it is not possible to stratify the entire list frame, a list frame sample of about the same size as the area frame sample may be much less efficient because it would lack the land use and geographic stratification. Since the "unknown" stratum is in essence a portion of the list that is not stratified, it is possible to do as well or better by relying on the area frame. A similar analysis could be repeated in each of the remaining states and somewhat different results might be obtained. However, the above illustration shows that careful construction and use of the list frame is necessary.

Three factors need to be briefly mentioned:

a. The problem is the optimum allocation of a sample to minimize sampling errors under cost constraints. It is important to attempt to obtain similar precision with a reduction in cost or a reallocation of resources.

b. Since the area frame does well for certain portions of the list, the full multiple frame estimator should greatly reduce sampling errors -- even with a reduction in sample sizes.

c. Some states use only 20 percent of the area frame sample to estimate for the nonoverlap domain even though data is available from all sample segments. As a result, most of the total sampling error comes from the nonoverlap domain. The most gains in reducing the sampling error of the multiple frame survey will come from using the entire area frame for the nonoverlap estimate. Data already available should be summarized before attempts are made to increase the coverage of the list frame. One of the states included in this analysis (Florida) used only 20 percent of the area frame. As a result, 1,511 farm operators were surveyed from the list to get an estimate with a CV of 4.7 percent where the complete area frame along with 275 extreme operators yielded an estimate with a CV of 5.5 percent. A more efficient use of survey resources would have resulted in a multiple frame estimate with a smaller CV yet with a smaller total sample size.

The conclusions from this two year study are that:

a. A more efficient (costs versus CV's) multiple frame estimate will be obtained if smaller portions of the list frames are used for sampling purposes.

b. The levels of the estimates are not affected by sampling smaller portions of the list frames.

c. The quality of the list frames need to be improved considerably to achieve gains over the area frame sample.

RECOMMENDATIONS

It is difficult to make blanket recommendations for all states since each has a "unique" list frame. However, the following recommendations do fit all states.

1. The entire list frame should not be sampled for a given specie.

    a. Strata consisting of "unknown size" should not be sampled from the list frame or where the resources are available to classify these operations into the correct stratum.

b. Strata consisting of operations with no livestock should also not be sampled from the list frame.

c. A frequent argument for including the unknown and zero livestock strata in the list frame is that survey data can be used for list updating purposes. However, only a small fraction of the elements in these strata are included in the survey and can therefore be updated. It is recommended that resources be committed to updating these strata in their entirety before the survey period. This means the unknown stratum will no longer exist. The large operators found in the unknown stratum will be assigned to the proper stratum. Then the zero stratum need not be sampled - data collected in the area frame will provide the estimate.

2. In several states, even small livestock strata need not be sampled. again, the objective should be to minimize the survey workload for the same precision. In some states this may require different nonoverlap domains for cattle than for hogs. This is no longer a problem because:

   a. States can accurately complete code boxes that would allow the computer to handle the situation where a tract is overlap for one specie but nonoverlap for the other.

   b. The use of the one questionnaire version eliminates the need for the pink questionnaire - thus the interviewer will have less work and will not be affected by the presence of two non-overlap domains.

3. The entire area frame should be used for nonoverlap estimation because the data is collected anyway. It is difficult to justify increasing the size of a list sample to reduce sampling errors when area frame data already collected would achieve as much or more efficiency.

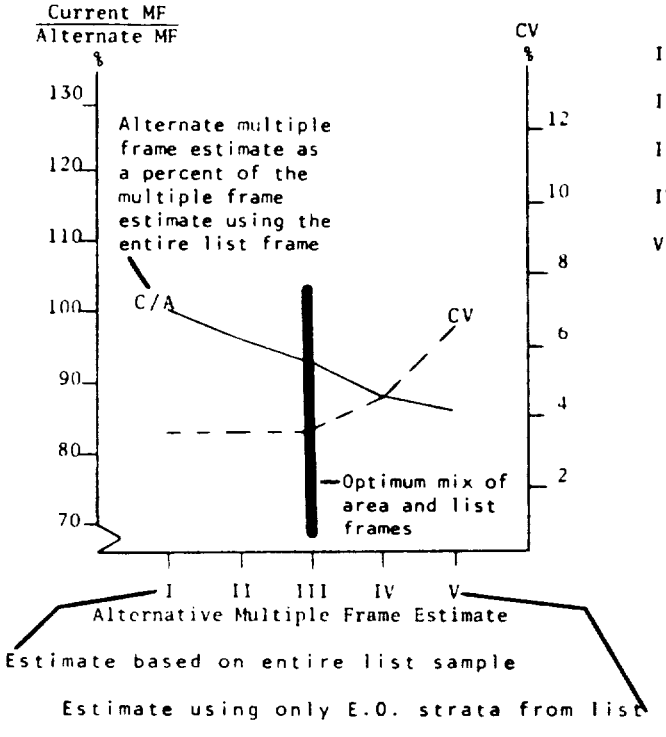
4. Maximum use of the area frame should be made by using complete multiple frame estimators such as Hartley's or Fuller's estimator. Even though the area frame is not as efficient as the list frame for larger-sized operations, the analysis indicates that it performs well enough that additional gains in sampling efficiency can be obtained by using all information that is collected from both sampling frames.

5. The final recommendation is that alternate multiple frame estimators as shown in the graphs be made available for Board review. The proper coding of the code boxes now on the JES questionnaires make such an analysis possible for the June and December survey periods. This will allow the Board to evaluate the source of level differences between the different indications. It will also identify situations where list frames are deteriorating.

APPENDIX A

GRAPHIC ILLUSTRATION OF THE ANALYSIS

THE FOLLOWING ILLUSTRATION EXPLAINS THE CONTENTS OF EACH GRAPH SHOWN IN THE APPENDIX.

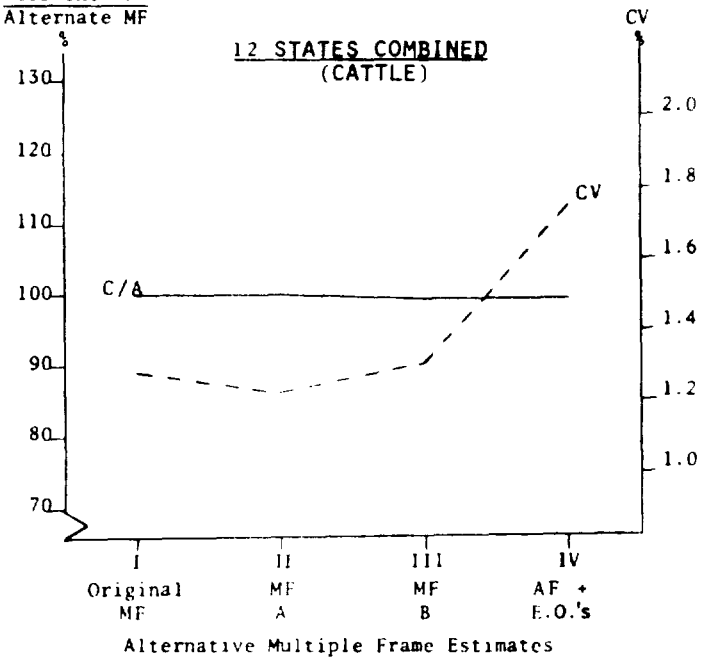


LIST FRAME

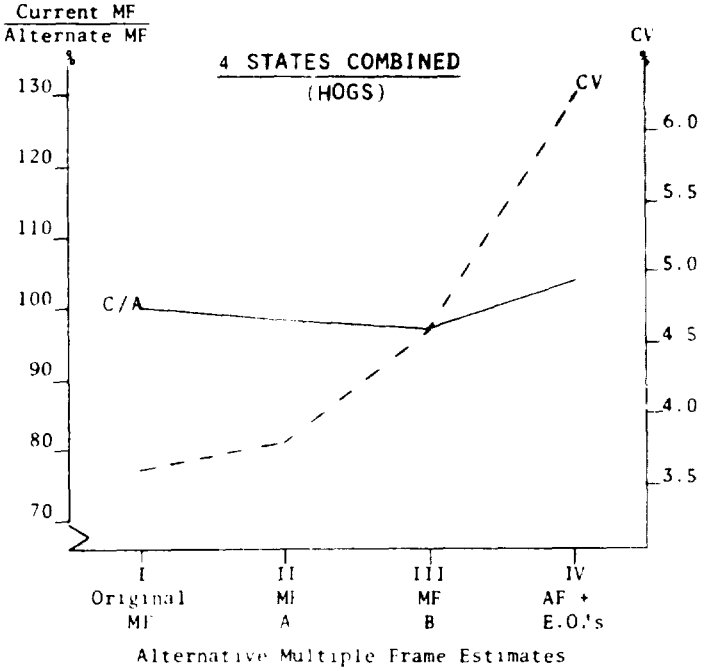
	N	n	n/N
I	120,944	1,863	.015
II			
III			
IV			
V	258	88	.341

List population and sample sizes for each multiple frame estimate

FIGURE 1--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, LIVESTOCK MULTIPLE FRAME SURVEY, JUNE 1974.

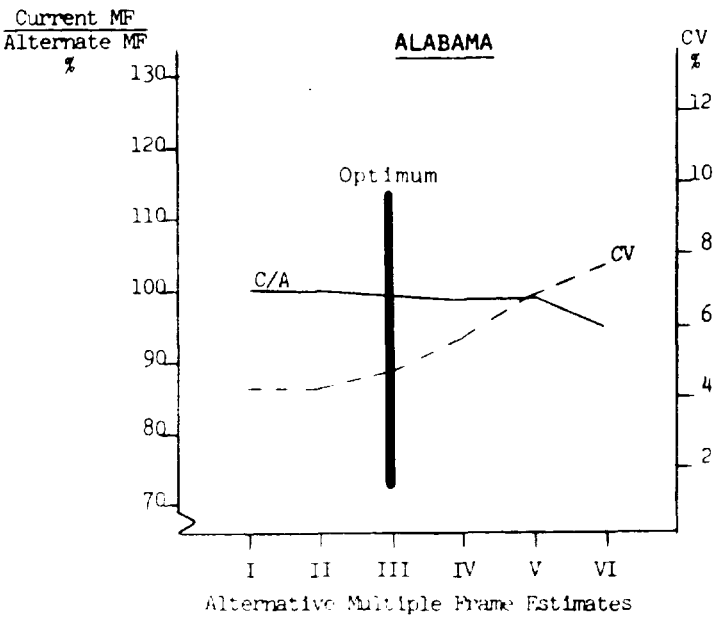


	LIST FRAME		
	N	n	n/N
I	836,766	20,838	.025
II	522,597	16,800	.032
III	219,670	12,011	.055
IV	4,305	2,130	.495

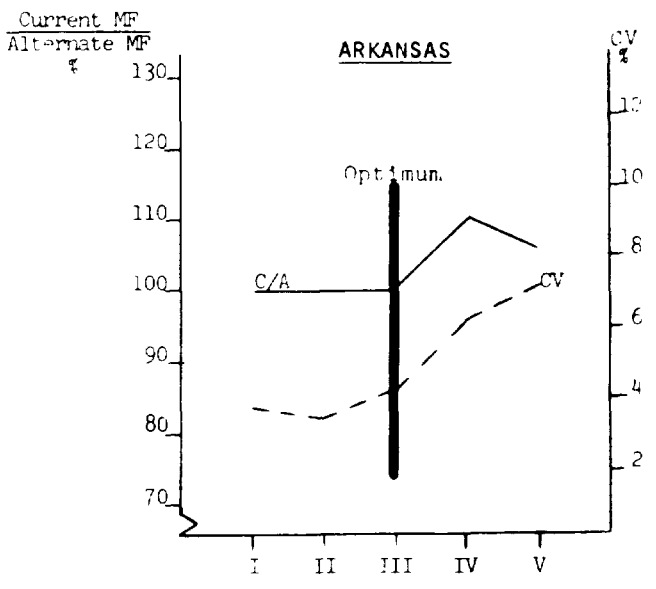


	LIST FRAME		
	N	n	n/N
I	472,412	7,271	.015
II	165,108	3,854	.023
III	36,021	2,182	.061
IV	1,650	473	.287

FIGURE 2--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, CATTLE MULTIPLE FRAME SURVEY, JUNE 1974.

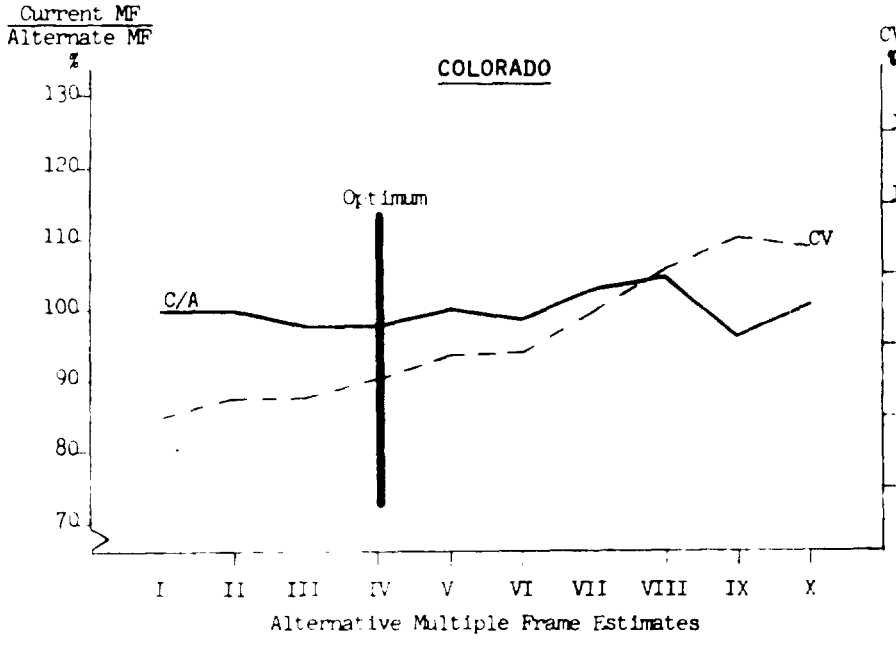


	LIST FRAME		
	N	n	n/N
I	28,333	1,544	.054
II	28,065	1,529	.054
III	10,035	1,022	.102
IV	4,617	692	.150
V	1,634	422	.258
VI	421	210	.499

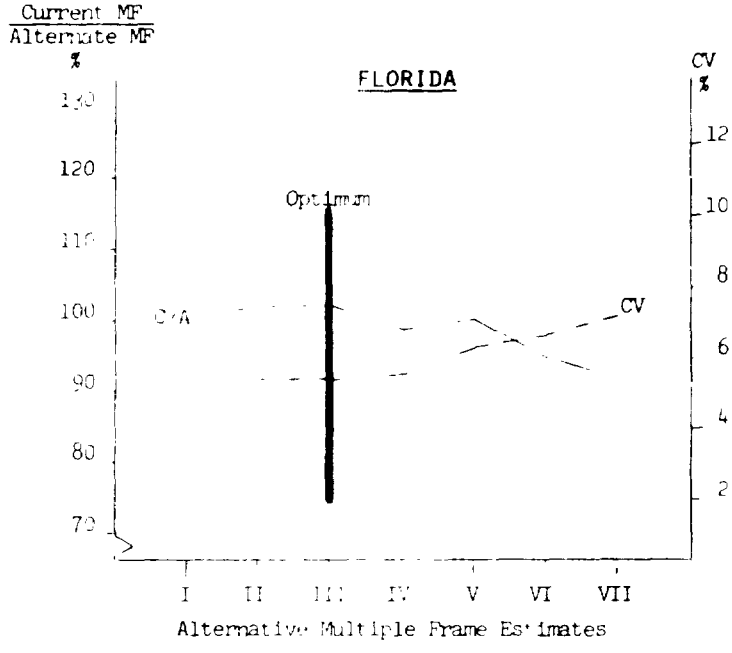


	LIST FRAME		
	N	n	n/N
I	68,783	1,882	.027
II	42,450	1,619	.038
III	24,272	1,289	.053
IV	3,491	445	.127
V	207	113	.546

FIGURE 3--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, CATTLE MULTIPLE FRAME SURVEY, JUNE 1974.

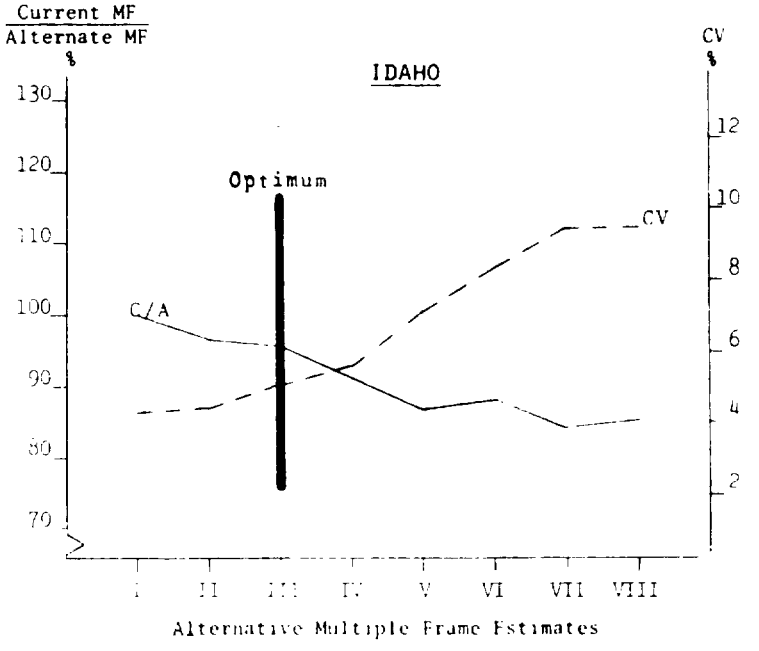


	LIST FRAME		
	N	n	n/N
I	19,547	1,522	.078
II	15,823	1,421	.090
III	13,313	1,370	.103
IV	7,580	913	.120
V	3,727	816	.219
VI	2,918	755	.259
VII	2,502	714	.285
VIII	1,586	560	.353
IX	698	367	.526
X	698	367	.526

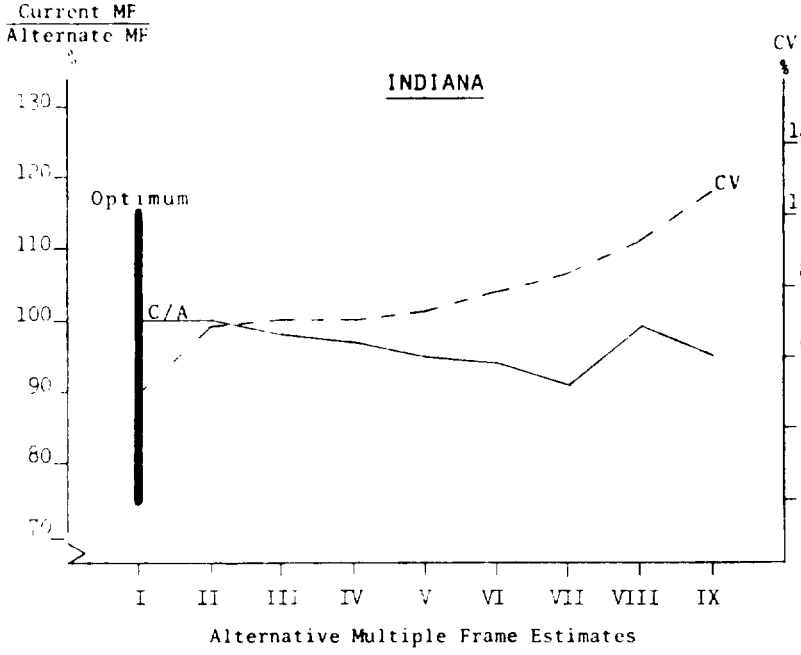


	LIST FRAME		
	N	n	n/N
I	6,609	1,511	.249
II	2,625	1,159	.442
III	2,534	1,149	.453
IV	896	561	.626
V	740	523	.707
VI	466	373	.800
VII	359	275	.766

FIGURE 4--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, CATTLE MULTIPLE FRAME SURVEY, JUNE 1974.

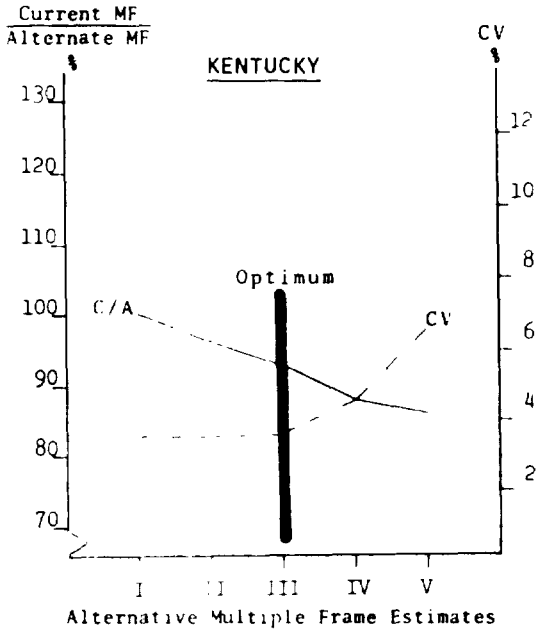


	LIST FRAME		
	N	n	n/N
I	18,326	1,347	.073
II	14,830	1,250	.084
III	7,092	977	.138
IV	3.701	695	.188
V	1,586	485	.306
VI	876	355	.405
VII	353	221	.626
VIII	353	221	.626

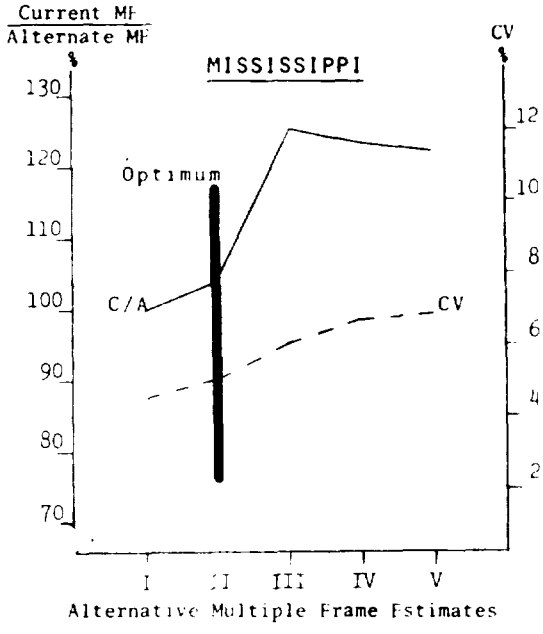


	LIST FRAME		
	N	n	n/N
I	83,121	1,667	.020
II	56,996	1,297	.022
III	48,007	1,075	.022
IV	47,093	1,060	.023
V	37,942	901	.024
VI	13,731	563	.041
VII	5,981	387	.065
VIII	1,918	226	.118
IX	204	72	.353

FIGURE 5--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, CATTLE MULTIPLE FRAME SURVEY, JUNE 1974.

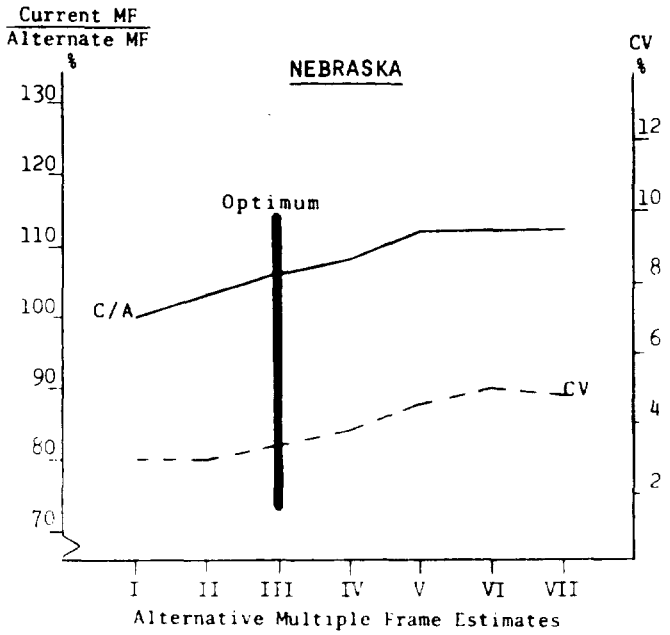


	LIST FRAME		
	N	n	n/N
I	120,944	1,863	.015
II	105,038	1,595	.011
III	54,738	1,260	.023
IV	15,686	653	.042
V	258	88	.341

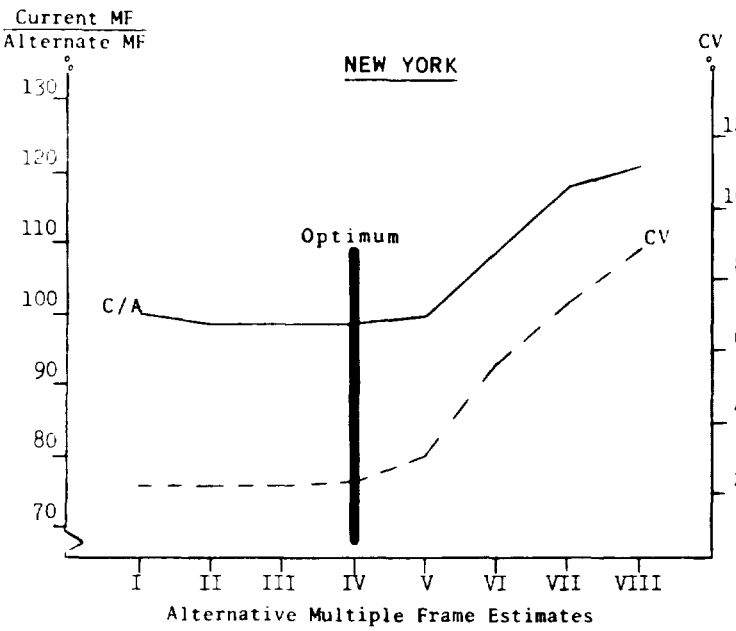


	LIST FRAME		
	N	n	n/N
I	96,296	1,568	.016
II	46,458	1,028	.022
III	4,110	268	.065
IV	570	109	.191
V	210	78	.371

FIGURE 6--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, CATTLE MULTIPLE FRAME SURVEY, JUNE 1974.

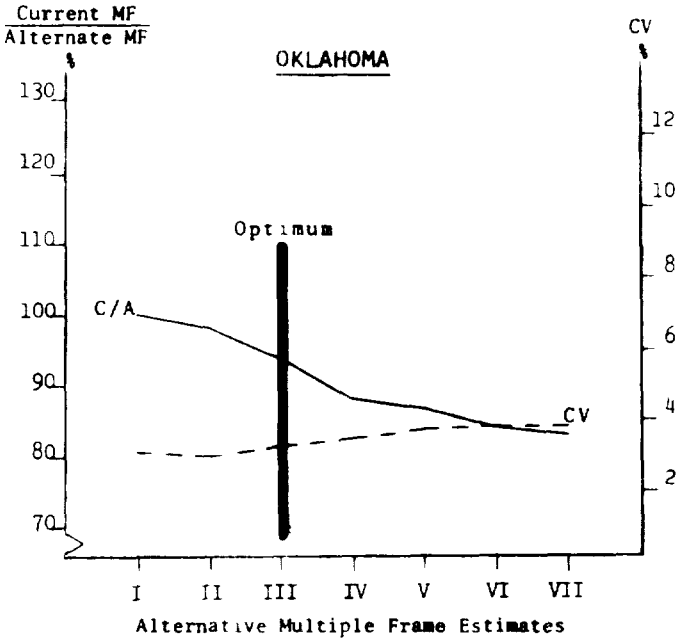


	LIST FRAME		
	N	n	n/N
I	60,084	1,366	.023
II	47,048	1,182	.025
III	22,909	847	.037
IV	11,823	677	.057
V	4,688	481	.103
VI	1,677	303	.181
VII	175	81	.463

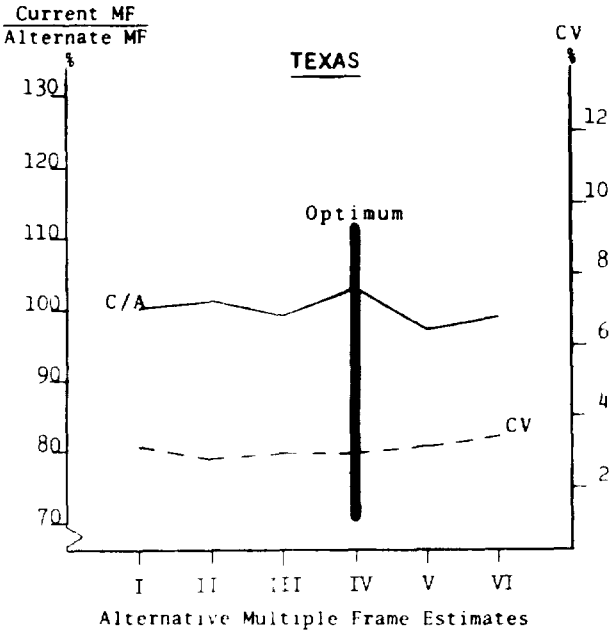


	LIST FRAME		
	N	n	n/N
I	32,112	1,715	.053
II	31,022	1,682	.054
III	27,564	1,539	.056
IV	23,114	1,453	.063
V	15,210	1,139	.075
VI	7,078	719	.102
VII	1,090	229	.210
VIII	181	83	.469

FIGURE 7--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, CATTLE MULTIPLE FRAME SURVEY, JUNE 1974.

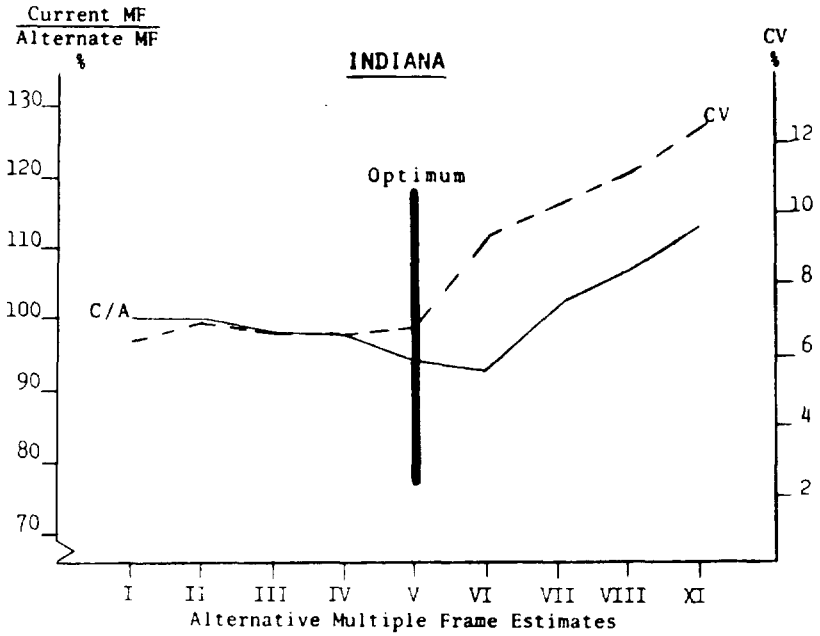


LIST FRAME	N	n	n/N
I	94,291	1,692	.018
II	74,479	1,500	.020
III	28,421	1,043	.037
IV	9,565	641	.067
V	3,272	395	.121
VI	735	215	.293
VII	641	198	.309

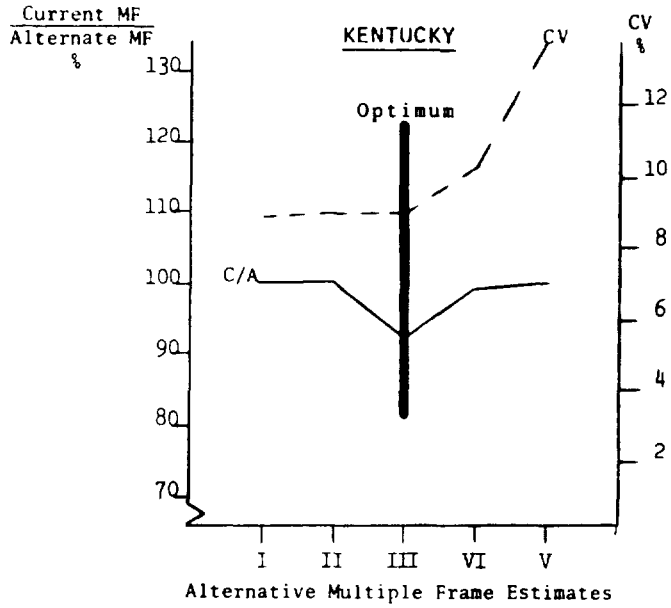


LIST FRAME	N	n	n/N
I	208,320	3,161	.015
II	94,857	1,785	.019
III	75,541	1,633	.022
IV	21,134	1,209	.057
V	6,664	884	.133
VI	600	344	.573

FIGURE 8--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, HOG MULTIPLE FRAME SURVEY, JUNE 1974.

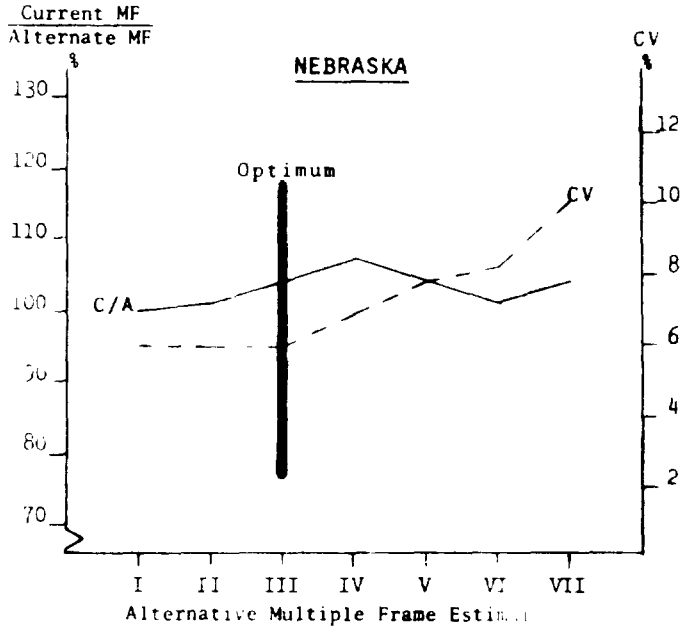


	LIST FRAME		
	N	n	n/N
I	83,158	1,061	.019
II	57,033	1,151	.020
III	34,909	1,040	.030
IV	33,995	1,021	.030
V	24,844	804	.032
VI	6,740	395	.059
VII	3,310	237	.072
VIII	1,152	156	.135
IX	344	90	.262

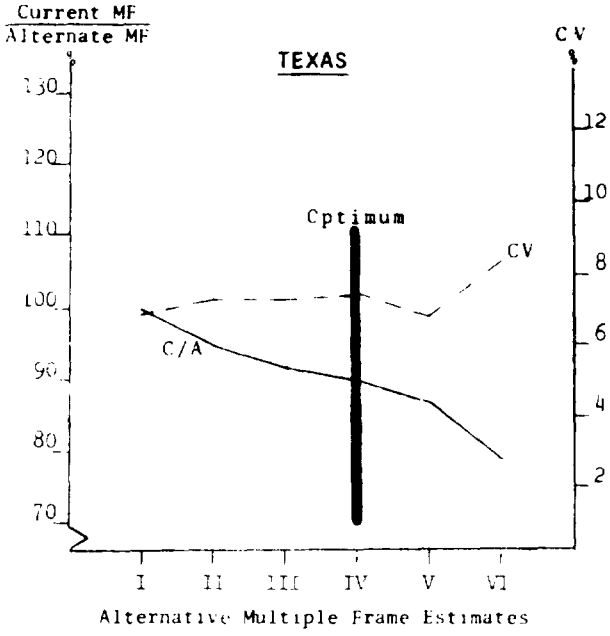


	LIST FRAME		
	N	n	n/N
I	120,944	1,865	.015
II	106,105	1,577	.015
III	15,378	782	.051
IV	5,105	546	.107
V	415	121	.212

FIGURE 9--A COMPARISON OF CURRENT MULTIPLE FRAME ESTIMATES, CV'S, AND LIST POPULATION AND SAMPLE SIZES WITH THOSE RESULTING FROM SAMPLING A SMALLER PORTION OF THE LIST FRAME, HOG MULTIPLE FRAME SURVEY, JUNE 1974.



	LIST FRAME		
	N	n	n/N
I	60,083	1,636	.027
II	47,040	1,440	.031
III	24,814	1,141	.046
IV	11,445	759	.066
V	6,808	578	.085
VI	3,644	406	.111
VII	603	158	.262



	LIST FRAME		
	N	n	n/N
I	208,226	2,169	.010
II	72,390	824	.011
III	9,345	332	.036
IV	2,458	246	.100
V	1,562	219	.140
VI	288	104	.361

APPENDIX B

A DESCRIPTION OF THE LIST FRAME STRATIFICATION FOR EACH STATE INCLUDED IN THE ANALYSIS FOLLOWS. STRATUM CODES ARE ALSO SHOWN.

Table B-1--Description of strata and strata codes used for July 1974 Cattle Multiple Frame surveys by state

	ALABAMA
01	0 - 49 cattle
02	50 - 99 cattle
03	100 - 199 cattle
04	200 - 499 cattle
06	Unknown
76	200 - 599 (08 dairy)
78	500 - 2499 (08 dairy)
79	600+ (dairy) and 2500+ cattle

	ARKANSAS
01	1 - 19 cattle
02	20 - 99 cattle
03	100 - 499 cattle
05	0 cattle
78	E.O. (500 - 2999 nondair
79	E.O. (09) incl. all 200+ dairy

	COLORADO
01	Unknown
02	1 - 274 (Brand list)
03	275 - 999 (Brand list)
04	0 cattle
05	1 - 199 cattle
06	200 - 399 cattle
07	400 - 999 cattle
11	1 - 199 milk cows
22	500 - 999 COF
23	1 - 499 COF
76	E.O. (08 dairy)
78	E.O. (08 nondairy)
79	E.O. (09 cattle)

	FLORIDA
01	1 - 99 beef
02	100 - 499 beef
03	500 - 999 beef
04	1000 - 1499 beef
05	1 - 99 dairy
06	100 - 499 dairy
76	E.O. (08 dairy)
79	E.O. (09)

Table B-2--Description of strata and strata codes used for July 1974 Cattle Multiple Frame surveys by state

	IDAHO		INDIANA
01	Unknown	01	No livestock
02	1 - 49 cattle	02	No cattle
03	50 - 99 cattle	03	Refusals
04	100 - 199 cattle	04	Nonresponse
05	200 - 299 cattle	05	1 - 24 cattle
06	300 - 699 cattle	06	25 - 49 cattle
76	200 - 499 (08 dairy)	07	50 - 99 cattle
78	700 - 5999 (08 nondairy)	08	100 - 499 cattle
79	E.O. (09 cattle)	76	E.O. (08 dairy)
		78	E.O. (08 nondairy)
		79	E.O. (09)
	KENTUCKY		MISSISSIPPI
41	0 - 9 cattle	01	1 - 99 cattle
42	10 - 49 cattle	02	100 - 299 cattle
43	50 - 499 cattle	03	300+ cattle
45	Don't Know	04	0 cattle (includes unclassified)
76	E.O. (08 dairy)	76	E.O. (08 dairy)
78	E.O. (08 nondairy)	78	E.O. (08 nondairy)
79	E.O. (09 cattle)	79	E.O. (09 cattle)

Table B-3--Description of strata and strata codes used for July 1974 Cattle Multiple Frame surveys by state

	NEBRASKA		NEW YORK
01	No livestock	01	Young stock only
02	0 - 24 cattle	02	0 cows
03	25 - 49 cattle	03	1 - 4 cows
04	50 - 99 cattle	04	5 - 29 cows
05	100 - 199 cattle	05	30 - 49 cows
06	200+ cattle	06	50 - 99 cows
78	E.O. (08 nondairy)	07	100 - 199 cows
79	E.O. (09 cattle)	76	E.O. (08 dairy)
		79	E.O. (09)

	OKLAHOMA		TEXAS
01	0 cattle	61	Unclassified
02	1 - 29 cattle	01	0 cattle
03	30 - 74 cattle	11	1 - 99 cattle
04	75 - 149 cattle	21	100 - 399 cattle
05	150 - 399 cattle	31	400 - 2999 cattle
06	400 - 999 cattle	76	E.O. (08 dairy)
76	E.O. (08 dairy)	78	E.O. (08 nondairy)
78	E.O. (08 nondairy)	79	E.O. (09 cattle)
79	E.O. (09 cattle)		

Table B-4--Description of strata and strata codes used for July 1974 Hog Multiple Frame Survey by state

	INDIANA		KENTUCKY
01	No livestock	61	0 - 9 hogs
02	No hogs	62	10 - 49 hogs
03	Refusals	63	50 - 499 hogs
04	Non-response	65	Unknown
05	1 - 99 hogs	78	E.O. (08)
06	100 - 199 hogs	79	E.O. (09)
07	200 - 399 hogs		
08	400 - 999 hogs		
78	E.O. (08)		
79	E.O. (09)		

	NEBRASKA		TEXAS
01	No livestock	26	Unclassified
02	No hogs	20	0 Hogs
03	1 - 124 hogs	21	1 - 49 hogs
04	125 - 199 hogs	22	50 - 99 hogs
05	200 - 299 hogs	23	100 - 499 hogs
06	300 - 499 hogs	24	E.O. (08)
78	E.O. (08)	25	E.O. (09)
79	E.O. (09)		

APPENDIX C

Detailed analysis tables for each state are included in the analysis. Alternative multiple frame estimates are shown beginning with those resulting from the entire list frame and ending with the estimate obtained when only the extreme operator strata are sampled from the list frame.

The nonoverlap portion of the estimate was computed in all states except Colorado and Idaho using both the tract (closed segment) and farm (open segment) expansions. Tracts containing land in the public domain are not classified by domain in the Western States, thus only the farm estimator could be used for the analysis.

The size of the list frame sampled along with the list sample size are shown for each estimate. The number of nonoverlap tracts used for each estimate are also shown. That portion of the area frame used for the original multiple frame estimate was used for this analysis.

Table C-1--Summary of estimates as list sample is reduced by stratum - Alabama 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		1,827.3	40.4	2.2	1,827.3	40.4	2.2	28,333	1,544
NOL	"	1,094.1	118.9	10.8	934.8	129.4	14.5		616
Total	" I	2,921.4	124.5	4.3	2,762.1	140.7	5.1		
List-Str. 6		1,810.7	39.5	2.2	1,810.7	39.5	2.2	28,065	1,529
NOL+Str. 6		1,124.2	121.0	10.8	934.8	134.8	14.4		618
Total	II	2,934.9	127.3	4.3	2,745.5	140.5	5.1		
List-Str. 6,1		1,381.1	30.1	2.2	1,381.1	30.1	2.2	10,035	1,022
NOL+Str. 6,1		1,514.6	131.6	8.7	1,171.0	142.3	12.1		736
Total	III	2,895.7	135.0	4.7	2,552.1	145.4	5.7		
List-Str. 6,1-2		1,023.0	23.0	2.2	1,023.0	23.0	2.2	4,617	692
NOL+Str. 6,1-2		1,853.9	160.2	8.6	1,437.8	173.4	12.1		795
Total	IV	2,876.9	161.9	5.6	2,460.8	175.0	7.1		
List-Str. 6,1-3		652.4	16.4	2.5	652.4	16.4	2.5	1,634	422
NOL+Str. 6,1-3		2,218.1	196.8	8.9	1,671.6	204.4	12.2		848
Total	V	2,870.5	197.5	6.9	2,324.0	205.1	8.8		
List-Str. 6,1-4		330.2	10.5	3.2	330.2	10.5	3.2	421	210
NOL+Str. 6,1-4		2,443.3	212.6	8.7	2,050.5	336.3	16.4		883
Total	VI	2,773.5	212.9	7.7	2,380.7	336.5	14.1		

Table C-2--Summary of estimates as list sample is reduced by stratum - Arkansas 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates	Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
	Tract			Farm			N	n
	DE	SE	CV	DE	SE	CV		
	(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)	2,214.0	78.6	3.6	2,214.0	78.6	3.6	68,783	1,882
NOL "	628.1	67.8	10.8	568.6	73.1	12.9		566
Total " I	2,842.1	103.8	3.7	2,782.6	107.4	3.9		
List-Str. 5	1,980.4	52.7	2.7	1,980.4	52.7	2.7	42,450	1,619
NOL+Str. 5	861.9	83.6	9.7	875.1	105.9	12.1		981
Total II	2,842.3	98.8	3.5	2,855.5	118.3	4.1		
List-Str. 5,1	1,658.4	45.7	2.8	1,658.4	45.7	2.8	24,272	1,289
NOL+Str. 5,1	1,190.6	110.7	9.3	1,181.6	127.6	10.8		1,146
Total III	2,849.0	119.8	4.2	2,840.0	135.5	5.5		
List-Str. 5,1,2	641.1	25.7	4.0	641.1	25.7	4.0	3,491	445
NOL+Str. 5,1,2	2,480.7	190.9	7.7	2,068.1	181.7	8.8		1,502
Total IV	3,121.8	192.6	6.2	2,709.2	183.5	6.8		
List-Str. 5,1,2,3	140.0	1.1	0.8	140.0	1.1	0.8	207	113
NOL+Str. 5,1,2,3	2,881.2	214.5	7.4	2,390.3	225.0	9.4		1,613
Total V	3,021.2	214.5	7.1	2,530.3	225.0	8.9		

Table C-3--Summary of estimates as list sample is reduced by stratum - Colorado 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates	Direct expansions using farm estimates of nonoverlap domain			Universe and sample size	
	Farm				
	DE	SE	CV	N	n
	(000)	(000)	(%)		
List (Orig.)	3,305.2	101.1	3.1	19,547	1,522
NOL "	508.5	114.9	22.6		521
Total " I	3,813.7	153.0	4.0		
List-Str. 1	3,086.3	91.0	3.1	15,823	1,421
NOL+Str.1	735.7	145.7	19.8		569
Total II	3,822.0	171.8	4.5		
List-Str. 1,4	3,033.7	86.5	2.9	13,313	1,370
NOL+Str. 1,4	735.9	145.8	19.8		593
Total III	3,769.6	169.5	4.5		
List-Str. 1,4,5	2,597.4	82.1	3.1	7,580	913
NOL+Str. 1,4,5	1,160.5	174.7	15.0		710
Total IV	3,757.9	193.1	5.1		
List-Str. 1,4,5,2	2,148.8	40.2	1.9	3,727	816
NOL+Str. 1,4,5,2	1,665.8	215.1	12.9		832
Total V	3,814.6	218.8	5.7		
List-Str.1,4,5,2,11	2,045.3	38.6	1.9	2,918	755
NOL+Str.1,4,5,2,11	1,745.0	217.7	12.5		855
Total VI	3,790.3	221.1	5.8		
List-Str.1,4,5,2,11,23	1,968.8	36.8	1.9	2,502	714
NOL+Str.1,4,5,2,11,23	1,948.7	268.4	13.8		869
Total VII	3,917.5	270.9	6.9		
List-Str.1,4,5,2,11,23,6	1,683.6	34.6	2.1	1,586	560
NOL+Str.1,4,5,2,11,23,6	2,330.7	326.9	14.0		908
Total VIII	4,014.3	328.7	8.2		
List-Str.1-7,11,22,23	1,283.3	25.7	2.0	698	367
NOL+Str. 1-7,11,22,23	2,424.0	331.6	13.7		927
Total IX	3,707.3	332.6	9.0		
List-Str.1-7,11,22,23,50	1,283.3	25.7	2.0	698	367
NOL+Str.1-7,11,22,23,50	2,577.1	338.6	13.1		976
Total X	3,860.4	339.6	8.8		

Table C-4--Summary of estimates as list sample is reduced by stratum - Florida 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates	Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
	Tract			Farm			N	n
	DE	SE	CV	DE	SE	CV		
	(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)	2,195.5	45.0	2.1	2,195.5	45.0	2.1	6,069	1,511
NOL "	988.6	142.8	14.4	707.8	143.1	20.2		339
Total I	3,184.1	149.8	4.7	2,903.3	150.0	5.2		
List-Str. 1	1,951.9	23.5	1.2	1,951.9	23.5	1.2	2,625	1,159
NOL+Str. 1	1,298.1	169.7	13.1	898.7	155.3	17.3		385
Total II	3,250.0	171.3	5.3	2,850.6	157.1	5.5		
List-Str. 1,5	1,941.8	23.3	1.2	1,941.8	23.3	1.2	2,534	1,149
NOL+Str. 1,5	1,298.1	169.7	13.1	898.7	155.3	17.3		385
Total III	3,239.9	171.3	5.3	2,840.5	157.0	5.5		
List-Str. 1-2,5	1,535.8	19.3	1.3	1,535.8	19.3	1.3	896	561
NOL+Str. 1-2,5	1,633.8	174.6	10.7	1,228.6	186.4	15.2		419
Total IV	3,169.6	175.7	5.5	2,764.4	187.4	6.8		
List-Str. 1-2,5-6	1,493.4	18.8	1.3	1,493.4	18.8	1.3	740	523
NOL+Str. 1-2, 5-6	1,689.4	196.4	11.6	1,228.6	186.4	15.2		419
Total V	3,182.8	197.3	6.2	2,722.0	187.4	6.9		
List-Str. 1-3,5-6	1,317.3	17.7	1.3	1,317.3	17.7	1.3	466	373
NOL+Str. 1-3,5-6	1,721.5	200.5	11.6	1,282.3	194.1	15.1		424
Total VI	3,038.8	201.3	6.6	2,560.0	194.9	7.5		
List-Str. 1-6	1,178.1	17.6	1.5	1,178.1	17.6	1.5	359	275
NOL+Str. 1-6	1,749.8	205.9	11.8	1,282.3	194.1	15.1		427
Total VII	2,927.9	206.6	7.1	2,460.4	194.9	7.9		

Table C-5--Summary of estimates as list sample is reduced by stratum - Idaho 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates	Direct expansions using farm estimates of nonoverlap domain			Universe and sample size	
	Farm			N	n
	DE	SE	CV		
	(000)	(000)	(%)		
List (Orig.)	2,140.5	78.7	3.7	18,326	1,347
NOL "	469.2	80.7	17.2		530
Total " I	2,609.7	112.7	4.3		
List-Str. 1	1,948.1	53.7	2.8	14,830	1,250
NOL+Str. 1	586.8	97.4	16.6		591
Total II	2,534.9	111.2	4.4		
List-Str. 1,2	1,697.7	45.8	2.7	7,092	977
NOL+Str. 1,2	812.2	116.1	14.3		733
Total III	2,509.9	124.8	5.0		
List-Str. 1-3	1,392.8	41.4	3.0	3,701	695
NOL+Str. 1-3	1,007.6	128.0	12.7		814
Total IV	2,400.4	134.5	5.6		
List-Str. 1-4	1,011.2	32.6	3.2	1,586	485
NOL+Str. 1-4	1,258.9	157.4	12.5		877
Total V	2,270.1	160.7	7.1		
List-Str. 1-5	815.6	30.9	3.8	876	355
NOL+Str. 1-5	1,481.7	188.2	12.7		904
Total VI	2,297.3	190.7	8.3		
List-Str. 1-6	580.0	27.2	4.7	353	221
NOL+Str. 1-6	1,619.5	205.7	12.7		922
Total VII	2,199.5	207.5	9.4		
List-Str. 1-6, 50	580.0	27.2	4.7	353	221
NOL+Str. 1-6, 50	1,631.6	205.6	12.6		1,044
Total VIII	2,211.6	207.4	9.4		

Table C-5--Summary of estimates as list sample is reduced by stratum - Idaho 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates		Direct expansions using farm estimates of nonoverlap domain			Universe and sample size	
		Farm			N	n
		DE	SE	CV		
		(000)	(000)	(%)		
List	(Orig.)	2,140.5	78.7	3.7	18,326	1,347
NOL	"	469.2	80.7	17.2		530
Total	" I	2,609.7	112.7	4.3		
List-Str. 1		1,948.1	53.7	2.8	14,830	1,250
NOL+Str. 1		586.8	97.4	16.6		591
Total	II	2,534.9	111.2	4.4		
List-Str. 1,2		1,697.7	45.8	2.7	7,092	977
NOL+Str. 1,2		812.2	116.1	14.3		733
Total	III	2,509.9	124.8	5.0		
List-Str. 1-3		1,392.8	41.4	3.0	3,701	695
NOL+Str. 1-3		1,007.6	128.0	12.7		814
Total	IV	2,400.4	134.5	5.6		
List-Str. 1-4		1,011.2	32.6	3.2	1,586	485
NOL+Str. 1-4		1,258.9	157.4	12.5		877
Total	V	2,270.1	160.7	7.1		
List-Str. 1-5		815.6	30.9	3.8	876	355
NOL+Str. 1-5		1,481.7	188.2	12.7		904
Total	VI	2,297.3	190.7	8.3		
List-Str. 1-6		580.0	27.2	4.7	353	221
NOL+Str. 1-6		1,619.5	205.7	12.7		922
Total	VII	2,199.5	207.5	9.4		
List-Str. 1-6, 50		580.0	27.2	4.7	353	221
NOL+Str. 1-6, 50		1,631.6	205.6	12.6		1,044
Total	VIII	2,211.6	207.4	9.4		

Table C-7--Summary of estimates as list sample is reduced by stratum - Kentucky 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates	Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
	Tract			Farm			N	n
	DE	SE	CV	DE	SE	CV		
	(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)	3,448.1	118.7	3.4	3,448.1	118.7	3.4	120,944	1,863
NOL "	740.8	91.0	12.3	637.2	85.8	13.5		557
Total I	4,188.9	149.6	3.6	4,085.3	146.4	3.6		
List-Str. 45	3,084.5	104.4	3.4	3,084.5	104.4	3.4	105,380	1,595
NOL+Str. 45	916.6	97.4	10.6	793.7	108.0	13.6		661
Total II	4,001.1	142.8	3.6	3,878.2	150.2	3.9		
List-Str. 45,41	2,648.2	78.0	2.9	2,648.2	78.0	2.9	54,738	1,260
NOL+Str. 45,41	1,243.9	114.2	9.2	1,184.7	144.4	12.2		996
Total III	3,892.1	138.3	3.6	3,832.9	164.1	4.3		
List-Str. 45,41,42	1,468.4	57.1	3.9	1,468.4	57.1	3.9	15,686	653
NOL+Str. 45,41,42	2,219.1	156.8	7.1	2,125.5	182.3	8.6		1,316
Total IV	3,687.5	166.9	4.5	3,593.9	191.1	5.3		
List-Str. 45,41,42,43	133.6	7.0	5.2	133.6	7.0	5.2	258	88
NOL+Str. 45,41,42,43	3,481.8	233.5	6.7	3,229.8	325.1	10.1		1,519
Total V	3,615.4	233.6	6.5	3,363.4	325.2	9.7		

Table C-7--Summary of estimates as list sample is reduced by stratum - Kentucky 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates	Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
	Tract			Farm			N	n
	DE	SE	CV	DE	SE	CV		
	(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)	3,448.1	118.7	3.4	3,448.1	118.7	3.4	120,944	1,863
NOL "	740.8	91.0	12.3	637.2	85.8	13.5		557
Total I	4,188.9	149.6	3.6	4,085.3	146.4	3.6		
List-Str. 45	3,084.5	104.4	3.4	3,084.5	104.4	3.4	105,380	1,595
NOL+Str. 45	916.6	97.4	10.6	793.7	108.0	13.6		661
Total II	4,001.1	142.8	3.6	3,878.2	150.2	3.9		
List-Str. 45,41	2,648.2	78.0	2.9	2,648.2	78.0	2.9	54,738	1,260
NOL+Str. 45,41	1,243.9	114.2	9.2	1,184.7	144.4	12.2		996
Total III	3,892.1	138.3	3.6	3,832.9	164.1	4.3		
List-Str. 45,41,42	1,468.4	57.1	3.9	1,468.4	57.1	3.9	15,686	65[illegible]
NOL+Str. 45,41,42	2,219.1	156.8	7.1	2,125.5	182.3	8.6		1,316
Total IV	3,687.5	166.9	4.5	3,593.9	191.1	5.3		
List-Str. 45,41,42,43	133.6	7.0	5.2	133.6	7.0	5.2	258	88
NOL+Str. 45,41,42,43	3,481.8	233.5	6.7	3,229.8	325.1	10.1		1,519
Total V	3,615.4	233.6	6.5	3,363.4	325.2	9.7		

Table C-9--Summary of estimates as list sample is reduced by stratum - Nebraska 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		6,670.7	187.1	2.8	6,670.7	187.1	2.8	60,084	1,366
NOL	"	989.5	131.6	13.3	1,551.5	589.9	38.0		271
Total	" I	7,660.2	228.7	3.0	8,222.2	618.8	7.5		
List-Str. 1		6,343.2	168.8	2.7	6,343.2	168.8	2.7	47,048	1,182
NOL+Str. 1		1,547.9	168.7	10.9	2,012.6	604.2	30.0		448
Total	II	7,891.1	238.7	3.0	8,355.8	627.3	7.5		
List-Str. 1,2		5,436.0	152.2	2.8	5,436.0	152.2	2.8	22,909	847
NOL+Str. 1,2		2,684.3	218.1	8.1	3,026.8	649.9	21.5		769
Total	III	8,120.3	265.9	3.3	8,462.8	667.5	7.9		
List-Str. 1-3		4,344.5	109.9	2.8	4,344.5	109.9	2.5	11,823	677
NOL+Str. 1-3		3,964.1	294.0	7.4	4,242.1	770.9	18.2		956
Total	IV	8,308.6	313.9	3.8	8,586.6	778.7	9.1		
List-Str. 1-4		3,070.1	89.0	2.9	3,070.1	89.0	2.9	4,688	481
NOL+Str. 1-4		5,553.5	378.4	6.8	5,937.3	998.9	16.8		1,107
Total	V	8,623.6	388.7	4.5	9,007.4	1,002.9	11.1		
List-Str. 1-5		1,978.5	72.3	3.7	1,978.5	72.3	3.7	1,677	303
NOL+Str. 1-5		6,578.3	412.7	6.3	7,034.7	1,153.6	16.4		1,190
Total	VI	8,556.8	419.0	4.9	9,013.2	1,155.8	12.8		
List-Str. 1-6		738.7	46.3	6.3	738.7	46.3	6.3	175	81
NOL+Str. 1-6		7,858.3	406.7	6.2	7,602.7	1,191.7	15.7		1,273
Total	VII	8,597.0	411.3	4.8	8,341.4	1,192.6	14.3		

Table C-9--Summary of estimates as list sample is reduced by stratum - Nebraska 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		6,670.7	187.1	2.8	6,670.7	187.1	2.8	60,084	1,366
NOL "		989.5	131.6	13.3	1,551.5	589.9	38.0		271
Total "	I	7,660.2	228.7	3.0	8,222.2	618.8	7.5		
List-Str. 1		6,343.2	168.8	2.7	6,343.2	168.8	2.7	47,048	1,182
NOL+Str. 1		1,547.9	168.7	10.9	2,012.6	604.2	30.0		448
Total	II	7,891.1	238.7	3.0	8,355.8	627.3	7.5		
List-Str. 1,2		5,436.0	152.2	2.8	5,436.0	152.2	2.8	22,909	847
NOL+Str. 1,2		2,684.3	218.1	8.1	3,026.8	649.9	21.5		769
Total	III	8,120.3	265.9	3.3	8,462.8	667.5	7.9		
List-Str. 1-3		4,344.5	109.9	2.8	4,344.5	109.9	2.5	11,823	677
NOL+Str. 1-3		3,964.1	294.0	7.4	4,242.1	770.9	18.2		956
Total	IV	8,308.6	313.9	3.8	8,586.6	778.7	9.1		
List-Str. 1-4		3,070.1	89.0	2.9	3,070.1	89.0	2.9	4,688	481
NOL+Str. 1-4		5,553.5	378.4	6.8	5,937.3	998.9	16.8		1,107
Total	V	8,623.6	388.7	4.5	9,007.4	1,002.9	11.1		
List-Str. 1-5		1,978.5	72.3	3.7	1,978.5	72.3	3.7	1,677	303
NOL+Str. 1-5		6,578.3	412.7	6.3	7,034.7	1,153.6	16.4		1,190
Total	VI	8,556.8	419.0	4.9	9,013.2	1,155.8	12.8		
List-Str. 1-6		738.7	46.3	6.3	738.7	46.3	6.3	175	81
NOL+Str. 1-6		7,858.3	406.7	6.2	7,602.7	1,191.7	15.7		1,273
Total	VII	8,597.0	411.3	4.8	8,341.4	1,192.6	14.3		

Table C-11--Summary of estimates as list sample is reduced by stratum - Oklahoma 1974 JES and Multiple Frame cattle and calf estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm				
		DE	SE	CV	DE	SE	CV	N	n
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		6,350.6	201.2	3.2	6,350.6	201.2	3.2	94,291	1,692
NOL	"	1,744.5	152.5	8.7	1,420.6	220.0	15.5		735
Total	" I	8,095.1	252.5	3.1	7,771.2	298.1	3.8		
List-Str. 1		6,042.5	186.0	3.1	6,042.5	186.0	3.1	74,479	1,500
NOL+Str. 1		1,902.9	155.2	8.1	1,640.4	232.8	14.2		867
Total	II	7,945.4	242.3	3.0	7,682.9	298.0	3.9		
List-Str. 1-2		4,541.4	137.9	3.0	4,541.4	137.9	3.0	28,421	1,043
NOL+Str. 1-2		3,037.5	195.9	6.4	2,593.1	267.2	10.3		1,278
Total	III	7,578.9	239.6	3.2	7,134.5	300.7	4.2		
List-Str. 1-3		2,744.2	108.9	4.0	2,744.2	108.9	4.0	9,565	641
NOL+Str. 1-3		4,398.1	228.2	5.2	3,749.5	342.6	9.1		1,607
Total	IV	7,142.3	252.9	3.5	6,493.7	359.5	5.5		
List-Str. 1-4		1,644.2	78.2	4.8	1,644.2	78.2	4.8	3,272	395
NOL+Str. 1-4		5,374.9	246.6	4.6	4,832.2	418.9	8.7		1,790
Total	V	7,019.1	258.7	3.7	6,476.4	426.1	6.6		
List-Str. 1-5		835.2	44.6	5.3	835.2	44.6	5.3	735	215
NOL+Str. 1-5		5,951.5	252.7	4.2	5,306.6	435.0	8.2		1,889
Total	VI	6,786.7	256.6	3.8	6,141.8	437.3	7.1		
List-Str. 1-6		799.6	44.1	5.5	799.6	44.1	5.5	641	198
NOL+Str. 1-6		5,975.7	252.6	4.2	5,306.6	435.0	8.2		1,892
Total	VII	6,775.3	256.5	3.8	6,106.2	437.3	7.2		

Table C-12--Summary of estimates as list sample is reduced by Stratum - Texas 1974 JES and Multiple Frame Cattle and Calf Estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		16,517.7	548.5	3.3	16,517.7	548.5	3.3	208,230	3,161
NOL "		2,105.1	171.3	8.1	1,280.6	171.1	13.4		996
Total "	I	18,622.8	574.6	3.1	17,798.3	574.5	3.2		
List-Str. 06		12,008.7	335.0	2.8	12,008.7	335.0	2.8	94,857	1,785
NOL+Str. 06		6,457.0	400.5	6.2	3,923.2	399.1	10.2		2,062
Total	II	18,465.7	522.1	2.8	15,931.9	521.1	3.3		
List-Str. 06,00		11,691.8	326.4	2.8	11,691.8	326.4	2.8	75,541	1,633
NOL+Str. 06,00		7,142.7	429.0	6.0	4,237.4	411.3	9.7		2,332
Total	III	18,834.5	539.1	2.9	15,929.2	525.1	3.3		
List-Str. 06,00,01		8.699.1	245.1	2.8	8,699.1	245.1	2.8	21,134	1,209
NOL+Str. 06,00,01		9,681.2	465.5	4.8	5,915.2	487.7	8.2		3,042
Total	IV	18,317.3	526.1	2.9	14,614.3	545.9	3.7		
List-Str. 06,00,01,02		5,928.1	199.9	3.4	5,928.1	199.9	3.4	6,664	884
NOL+Str. 06,00,01,02		13,177.9	564.4	4.3	8,815.9	1,344.0	15.2		3,436
Total	V	19,106.0	598.8	3.1	14,744.0	1,358.8	9.2		
List-Str. 06,00,01,02,03		2,743.5	86.6	3.2	2,743.5	86.6	3.2	600	344
NOL+Str. 06,00,01,02,03		16,233.0	630.4	3.9	10,369.7	1,440.1	13.9		3,656
Total	VI	18,976.5	636.3	3.4	13,113.2	1,442.7	11.0		

Table C-13--Summary of estimates as list sample is reduced by stratum - Indiana 1974 JES and Multiple Frame hog and pig estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		3,094.1	190.2	6.1	3,094.1	190.2	6.1	83,158	1,601
NOL	"	437.4	120.2	27.5	642.4	240.6	37.5		303
Total	" I	3,531.5	225.0	6.4	3,736.5	306.7	8.2		
List-Str. 1		2,903.7	184.3	6.3	2,903.7	184.3	6.3	57,033	1,151
NOL+Str. 1		617.8	159.1	25.8	838.3	266.5	31.8		435
Total	II	3,521.5	243.5	6.9	3,742.0	324.0	8.7		
List-Str. 1,2		2,721.9	123.1	4.5	2,721.9	123.1	4.5	34,909	1,040
NOL+Str. 1,2		742.5	192.3	25.9	998.9	291.7	29.2		582
Total	III	3,464.4	228.4	6.6	3,720.8	316.6	8.5		
List-Str. 1-3		2,711.7	122.8	4.5	2,711.7	122.8	4.5	33,995	1,021
NOL+Str. 1-3		774.7	194.7	25.1	1,031.1	293.0	28.4		588
Total	IV	3,486.4	230.2	6.6	3,742.8	317.7	8.5		
List-Str. 1-4		2,510.4	112.2	4.5	2,510.4	112.2	4.5	24,844	804
NOL+Str. 1-4		805.5	195.9	24.3	1,040.5	293.0	28.2		636
Total	V	3,315.9	225.7	6.8	3,550.9	313.7	8.8		
List-Str. 1-5		1,618.9	74.9	4.6	1,618.9	74.9	4.6	6,740	395
NOL+Str. 1-5		1,672.6	300.3	18.0	2,083.4	367.7	17.6		782
Total	VI	3,291.5	309.5	9.4	3,702.3	375.2	10.1		
List-Str. 1-6		1,165.8	63.7	5.5	1,165.8	63.7	5.5	3,310	237
NOL+Str. 1-6		2,439.4	363.6	14.9	3,201.6	530.0	16.6		835
Total	VII	3,605.2	369.1	10.2	4,367.4	533.9	12.2		
List-Str. 1-7		750.6	45.1	6.0	750.6	45.1	6.0	1,152	156
NOL+Str. 1-7		3,019.8	416.8	13.8	4,062.8	660.3	16.3		867
Total	VIII	3,770.4	419.3	11.1	4,813.4	661.8	13.7		
List-Str. 1-8		386.0	28.5	7.4	386.0	28.5	7.4	344	90
NOL+Str. 1-8		3,617.0	492.0	13.6	4,780.5	758.0	15.9		883
Total	IX	4,003.0	492.8	12.3	5,166.5	758.5	14.7		

Table C-13--Summary of estimates as list sample is reduced by stratum - Indiana 1974 JES and Multiple Frame hog and pig estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		3,094.1	190.2	6.1	3,094.1	190.2	6.1	83,158	1,601
NOL	"	437.4	120.2	27.5	642.4	240.6	37.5		303
Total	" I	3,531.5	225.0	6.4	3,736.5	306.7	8.2		
List-Str. 1		2,903.7	184.3	6.3	2,903.7	184.3	6.3	57,033	1,151
NOL+Str. 1		617.8	159.1	25.8	838.3	266.5	31.8		435
Total	II	3,521.5	243.5	6.9	3,742.0	324.0	8.7		
List-Str. 1,2		2,721.9	123.1	4.5	2,721.9	123.1	4.5	34,909	1,040
NOL+Str. 1,2		742.5	192.3	25.9	998.9	291.7	29.2		582
Total	III	3,464.4	228.4	6.6	3,720.8	316.6	8.5		
List-Str. 1-3		2,711.7	122.8	4.5	2,711.7	122.8	4.5	33,995	1,021
NOL+Str. 1-3		774.7	194.7	25.1	1,031.1	293.0	28.4		588
Total	IV	3,486.4	230.2	6.6	3,742.8	317.7	8.5		
List-Str. 1-4		2,510.4	112.2	4.5	2,510.4	112.2	4.5	24,844	804
NOL+Str. 1-4		805.5	195.9	24.3	1,040.5	293.0	28.2		636
Total	V	3,315.9	225.7	6.8	3,550.9	313.7	8.8		
List-Str. 1-5		1,618.9	74.9	4.6	1,618.9	74.9	4.6	6,740	395
NOL+Str. 1-5		1,672.6	300.3	18.0	2,083.4	367.7	17.6		782
Total	VI	3,291.5	309.5	9.4	3,702.3	375.2	10.1		
List-Str. 1-6		1,165.8	63.7	5.5	1,165.8	63.7	5.5	3,310	237
NOL+Str. 1-6		2,439.4	363.6	14.9	3,201.6	530.0	16.6		835
Total	VII	3,605.2	369.1	10.2	4,367.4	533.9	12.2		
List-Str. 1-7		750.6	45.1	6.0	750.6	45.1	6.0	1,152	156
NOL+Str. 1-7		3,019.8	416.8	13.8	4,062.8	660.3	16.3		867
Total	VIII	3,770.4	419.3	11.1	4,813.4	661.8	13.7		
List-Str. 1-8		386.0	28.5	7.4	386.0	28.5	7.4	344	90
NOL+Str. 1-8		3,617.0	492.0	13.6	4,780.5	758.0	15.9		883
Total	IX	4,003.0	492.8	12.3	5,166.5	758.5	14.7		

Table C-15--Summary of estimates as list sample is reduced by stratum - Nebraska 1974 JES and Multiple Frame hog and pig estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		2,721.4	84.4	3.1	2,721.4	84.4	3.1	60,083	1,636
NOL "		687.7	186.9	27.2	493.8	128.9	26.1		271
Total "	I	3,409.1	205.2	6.0	3,215.3	154.3	4.8		
List-Str. 1		2,654.4	81.3	3.1	2,654.4	81.3	3.1	47,040	1,440
NOL+Str. 1		789.4	190.2	24.1	569.2	133.2	23.4		454
Total	II	3,443.8	206.8	6.0	3,223.6	156.1	4.8		
List-Str. 1,2		2,602.3	79.2	3.0	2,602.3	79.2	3.0	24,814	1,141
NOL+Str. 1,2		928.8	197.3	21.2	675.0	142.7	21.1		887
Total	III	3,531.1	212.6	6.0	3,277.3	163.2	5.0		
List-Str. 1-3		2,095.8	69.2	3.3	2,095.8	69.2	3.3	11,445	759
NOL+Str. 1-3		1,550.7	241.6	15.6	1,267.8	192.4	15.2		1,101
Total	IV	3,646.5	251.3	6.9	3,363.6	204.5	6.1		
List-Str. 1-4		1,536.4	58.2	3.8	1,536.4	58.2	3.8	6,808	578
NOL+Str. 1-4		2,001.1	264.5	13.2	1,998.4	298.5	14.9		1,183
Total	V	3,537.5	270.8	7.7	3,534.8	304.1	8.6		
List-Str. 1-5		1,110.9	49.0	4.4	1,110.9	49.0	4.4	3,644	406
NOL+Str. 1-5		2,326.1	280.2	12.0	2,689.0	522.4	19.4		1,240
Total	VI	3,437.0	284.5	8.3	3,799.9	524.7	13.8		
List-Str. 1-6		383.9	27.5	7.2	383.9	27.5	7.2	603	158
NOL+Str. 1-6		3,156.7	353.2	11.2	3,582.9	652.2	18.2		1,306
Total	VII	3,540.6	354.3	10.0	3,966.8	652.8	16.5		

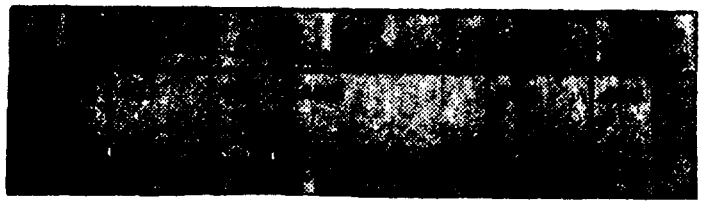
Table C-16--Summary of estimates as list sample is reduced by stratum - Texas 1974 JES and Multiple Frame hog and pig estimates

Multiple frame estimates		Direct expansions using tract and farm estimates of nonoverlap domain						Universe and sample size	
		Tract			Farm			N	n
		DE	SE	CV	DE	SE	CV		
		(000)	(000)	(%)	(000)	(000)	(%)		
List (Orig.)		766.4	53.0	6.9	881.4	108.1	12.3	208,226	2,169
NOL "		146.5	32.2	22.0	130.0	30.1	23.2		996
Total "	I	912.9	62.1	6.8	1,011.4	112.2	11.1		
List-Str. 26		630.1	45.7	7.3	630.1	45.7	7.3	72,390	824
NOL+Str. 26		234.5	42.8	18.2	241.5	47.2	19.5		2,361
Total	II	864.6	62.6	7.2	871.6	65.7	7.5		
List-Str. 26,20		567.4	39.1	6.9	567.4	39.1	6.9	9,345	332
NOL+Str. 26,20		273.1	46.2	16.9	255.7	48.0	18.8		3,523
Total	III	840.5	60.6	7.2	823.1	61.9	7.5		
List-Str. 26,20,21		504.4	35.5	7.0	504.4	35.5	7.0	2,458	246
NOL+Str. 26,20,21		315.6	49.3	15.6	281.7	51.0	18.1		3,647
Total	IV	820.0	60.7	7.4	786.1	62.1	7.9		
List-Str. 26,20,21,22		454.6	19.0	4.2	454.6	19.0	4.2	1,562	219
NOL+Str. 26,20,21,22		338.8	50.6	14.9	295.1	52.5	17.8		3,661
Total	V	793.4	54.0	6.8	749.7	55.9	7.5		
List-Str. 26,20,21,22,23		343.3	15.0	4.4	343.3	15.0	4.4	288	104
NOL+Str. 26,20,21,22,23		377.8	57.7	15.3	338.9	62.2	18.3		3,684
Total	VI	721.1	59.7	8.3	682.2	64.0	9.4		

APPENDIX D

SUMMARY PROCEDURES

A relatively simple procedure was used to prepare the area frame data for the analysis. The analysis was possible because of the addition of special code boxes on the 1974 JES questionnaire. The code boxes are illustrated below.



The code boxes were completed as follows:

401 - Partial nonoverlap factor for nonoverlap tracts - blank otherwise.

402 - 403 List ID number of name on list making the tract overlap.

404 - 405 Hog and cattle strata codes of name on list making the tract overlap. Strata codes 78 and 79 indicated the tract operator was also an extreme operator.

These code boxes could be used in the operational survey to:

1. use the computer to account for all nonoverlap tracts;
2. prepare a master record of nonoverlap tracts for subsequent surveys;
3. compute a tract estimate of the nonoverlap domain with a minimum of effort, through a reformat program;
4. identify tract operators who were also selected from the list frame to reduce respondent burden.

These code boxes were completed by 12 state statistical offices during the 1974 JES. Then the following data tapes were obtained for June 1974 survey data for the selected states:

1. List frame sample by stratum plus the nonoverlap domain.
2. Area frame sample by land use or geographic stratum plus the extreme operators.

These data tapes contained all ID codes, survey data and expansion factors needed to compute the estimates and their sampling errors. Every tract in the portion of the area frame used for the multiple frame survey also contained the coded data described above for the 12 states involved. In most states, the nonoverlap domain is defined for only nonrotated segments, usually 80 percent of the total sample. Florida defined the nonoverlap domain for 20 percent of the entire area frame. These codes identified for every tract whether it was in the nonoverlap domain or whether it was overlap with the list. If the tract overlapped the list frame, then it was estimating for an operation that could also have been selected from the list frame.

Now since the list frame is stratified, it was also possible to determine the stratum each overlap tract was estimating for. The entire overlap domain provides an independent estimate of livestock represented by the list frame. The list frame estimate is the sum of the estimates from each independent stratum. The important factor involved in this analysis is that the area frame will also provide an estimate of each list frame stratum. The sum of the area frame estimates for each list stratum is the area frame estimate for the list frame.

The codes mentioned above provided the basis for this analysis. For example, the codes identified which of the area frame tracts were overlap with the "unknown" list stratum. The area frame expansion factor times the cattle in these tracts provided the area frame estimate for the unknown strata. Therefore, we have two independent estimates of the unknown stratum - one from the area frame, the other from the list frame. Each also has an independent sampling error which provides a measure of the reliability of the estimate. These procedures were repeated to obtain an area frame estimate for each list stratum. Figure A also depicts these procedures using Texas data.

The weighted segment estimator is currently used to estimate for the nonoverlap domain. Data were not available to compute the weighted estimator for the overlap tracts. Therefore, all area frame expansions were computed using the tract method of expansion. For comparison purposes, the estimates for the original nonoverlap domain were recomputed using the tract estimator.

The most important factor considered when comparing estimates between the area and list frames was their sampling errors. Some additional factors need to be considered when the sampling errors are computed for each domain. These are illustrated in Figure B and discussed below:

1. The sampling unit is a segment. The sampling error is computed around all segments in the sample.

2. The only data included in each segment total are the number of livestock associated with the tract overlapping a particular stratum. To illustrate for the domain estimation for stratum 00 in Texas:

    a. Only livestock in tracts overlapping stratum 00 are included in the segments.

b. If the segment does not contain any tracts overlapping stratum 00 or any agricultural tracts, then the segment is given a value of zero.

3. In essence, the complete area frame is summarized to compute the sampling error for each domain. For Texas, the area frame was processed six times, first for the nonoverlap domain, then for the five overlap domains. Each time, all 848 segments were included in the summary.

The next step in the summary process was to recompute the multiple frame estimator using different portions of the area and list sampling frames. For example, we wanted to evaluate the effects of letting the nonoverlap domain become larger and therefore eliminating certain strata from the list.

Each time a list stratum was dropped, the nonoverlap domain became larger because it contained tracts that were previously overlap. This meant that the entire area frame sample had to again be resummarized, because the sampling errors are not additive when combining domains. For example, when the nonoverlap domain was enlarged to include tracts overlap with say stratum 6, the sampling error had to be recomputed around the new segment totals. The data in each segment was the livestock for the non-overlap tracts plus livestock in tracts overlap with that stratum.

The final summary step was to compute two modified multiple frame estimates (A and B) for each state. The Modified A estimate combines the tracts that overlap the zero and unknown livestock strata with the nonoverlap domain. The comparable strata are then excluded from the list estimate. The Modified B estimate also includes tracts that overlap the small livestock stratum with the nonoverlap domain.

Figure A: An Illustration of How the Area Frame Tracts Were Divided Into Domains Using Texas 1974 Survey Data

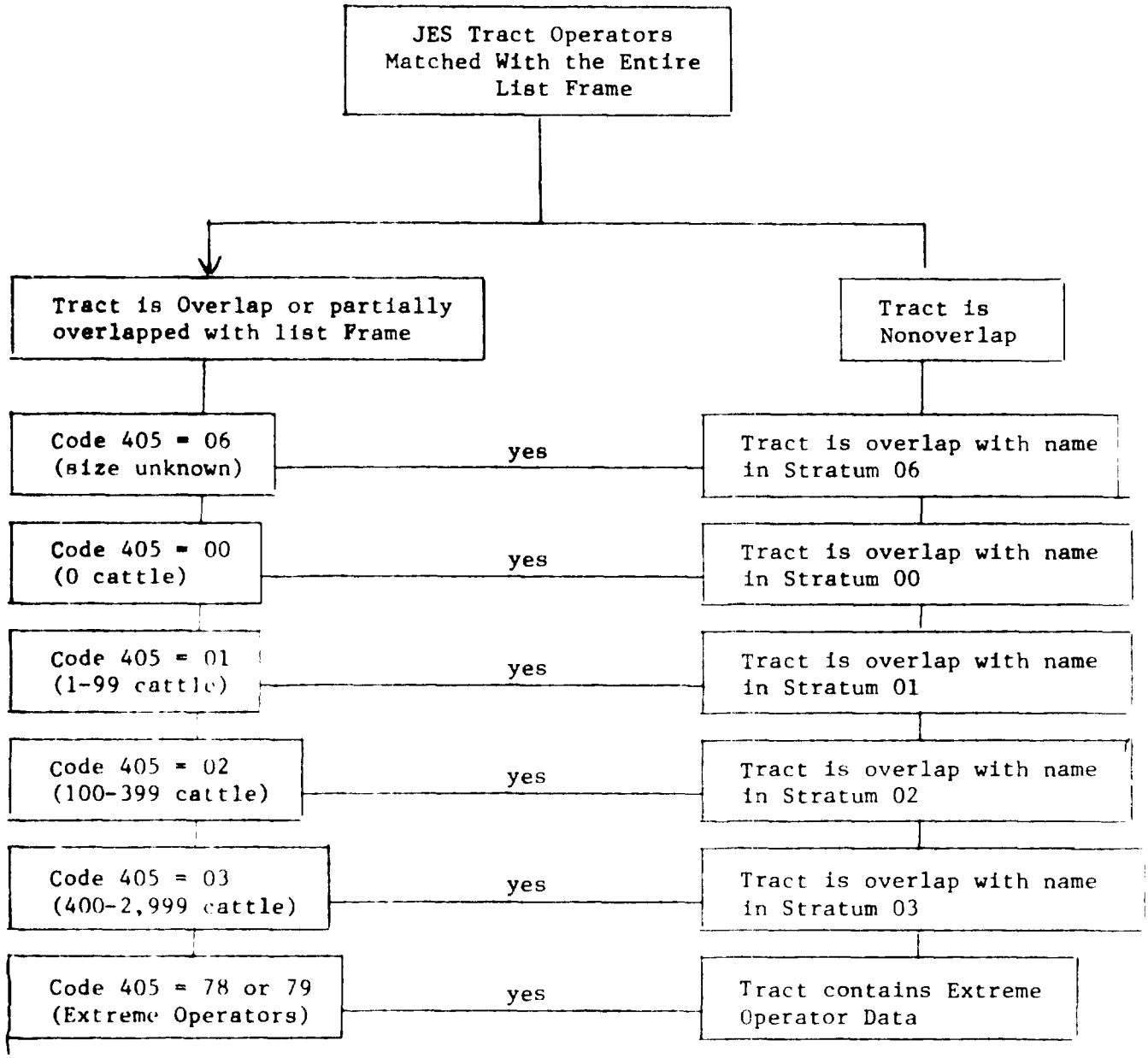
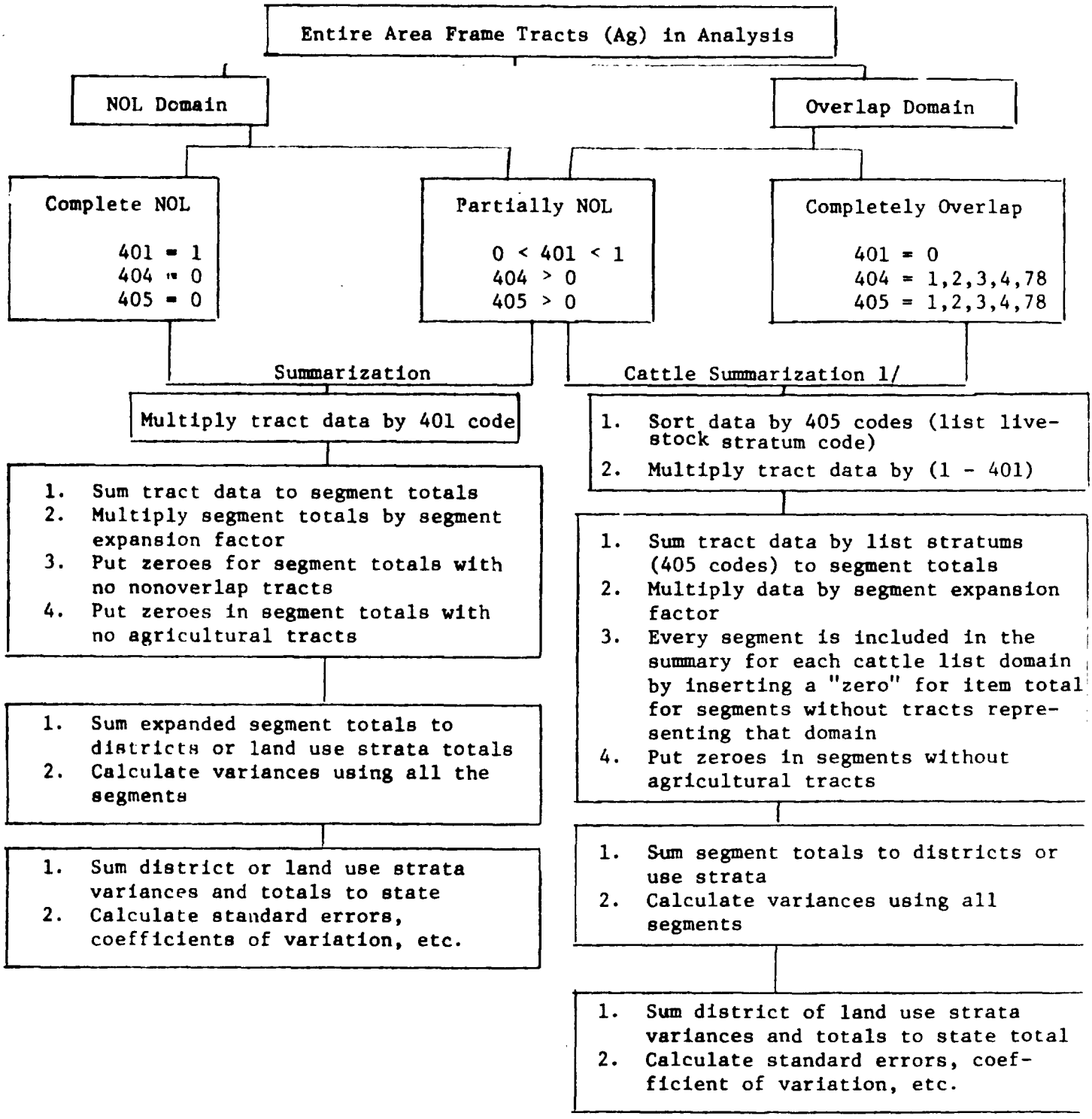


Figure B: Method of Summarization by Domain for Area Frame Example



1/ For hog summarization of area frame, replace 405 by 404 and cattle by hogs.