United States
Department of
Agriculture

National
Agricultural
Statistics
Service

Research and
Applications
Division

NASS Staff Report
Number SSB-88-06

June 1988

Prospects for Conducting Household Surveys with an Agricultural Area Frame

Jack Nealon

Prospects For Conducting Household Surveys With An Agricultural Area Frame. Jack Nealon, Research and Applications Division, National Agricultural Statistics Service, U.S. Department of Agriculture, Washington, D.C. 20250, June 1988. Staff Report No. SSB-88-06.

ABSTRACT

Basic analysis was conducted to assess the feasibility of using an agricultural area sampling frame to survey more than just farm households. Two populations were examined, namely, the rural and entire populations. Analysis indicated that modifications to the area frame design would be necessary to survey these populations efficiently.

CONTENTS

SUMMARY

Data collected during the 1987 June Enumerative Survey on the total number of households provided the opportunity to investigate the use of agricultural area frames to survey populations broader in scope than the farm population. The analysis indicated that modifications to the area frame design would be necessary to survey properly the rural and general populations. These modifications include: (1) expanding the use of substratification in the urban and ag-urban strata, (2) increasing the sample size in urban and ag-urban areas, and (3) formulating robust procedures to handle outliers that severely distort the estimates of survey totals and variances. Finally, the data collection procedures used during the 1987 JES to count non-farm households would need to be improved.

PROSPECTS FOR CONDUCTING HOUSEHOLD SURVEYS WITH AN AGRICULTURAL AREA FRAME

Jack Nealon

INTRODUCTION

Area sampling frames provide the statistical foundation for the national and state agricultural survey program in the National Agricultural Statistics Service (NASS). This program includes surveys concerned with crop production and stocks, livestock inventories, farm production expenditures, and farm labor. An area frame provides complete coverage of the land area in a state, and, therefore, complete coverage of the farm sector for agricultural surveys. Random selection of a sample of land areas from an area frame provides NASS the framework to generate unbiased agricultural statistics with measurable precision levels.

NASS's use of area sampling frames has been restricted to the farm population. Area frames are developed and sampled with the farm sector in mind so that the most precise agricultural statistics can be provided within budget limitations. Recently, however, NASS has been encouraged to have the capability to conduct general household surveys for the entire United States or for rural America [2]. The question that has not been explored by NASS is: "Are our current area frame stratification and area frame sample allocation suitable for populations such as the entire or rural population?" If not, what design changes would be necessary?

During the 1987 June Enumerative Survey (JES), a count of the total number of households (farm and non-farm) was obtained for each of the 15,973 sample land areas (called segments). Historically, only a count of the number of farm households was available. Therefore, the opportunity presented itself for the first time to conduct a basic evaluation of the suitability of NASS's area frames for surveying more than the farm sector.

This report presents preliminary analysis to assess our current area frame design relative to survey populations broader than the farm population.

LIMITATIONS

Screening procedures that were more intensive and structured than the traditional procedures were used in densely populated areas during the 1987 JES [1]. These procedures were used to maximize the number of farm households detected during the survey so that the Bureau of the Census would have a thoroughly screened area frame sample of farm households for use in the 1987 Census of Agriculture. Due to the expense and data collection complexities, NASS returned to the traditional screening methods in 1988. Therefore, this analysis is based on an area sample that was screened for farm households more rigorously during the JES than in the past and foreseeable future.

The Bureau of the Census and NASS also decided to retain sample segments in the urban and ag-urban areas that would normally have rotated out after the customary five-year sampling cycle. This decision was made to provide greater sample coverage in the densely populated areas. This resulted in 308 additional sample segments in the 1987 JES. Therefore, the sample distribution for the 1987 JES is slightly different from normal years.

As mentioned earlier, a count of the total number of households was obtained for each segment. This was the only characteristic available for the non-farm population. Therefore, the analysis is restricted to only one variable -- a count of households.

The number of farm households estimated from the 1987 JES in the 48 contiguous states was 2,138,399 with a standard error of 33,741, which is close to NASS's official estimate of 2,168,550. To the contrary, 85.6 million occupied and vacant households with a standard error of 3,526,138 were estimated in the coterminous U.S. from the 1987 JES compared with 101.6 million reported in the U.S. by the Current Population Survey (CPS) with a standard error of 238,000 for the second quarter of 1987 [3]. The difference between the number of households from the 1987 JES and 1987 CPS cannot be analyzed effectively in more detail since the Bureau of Census does not publish state-level estimates on occupied and vacant households from the CPS. The most recent source of state-level numbers on occupied and vacant households from the Bureau of Census is the 1980 Census of Population. The seven-year difference in survey dates prohibits meaningful comparisons since the number of households can change considerably with time, e.g. 20 percent increase in households from 1960 to 1970 and a 28 percent increase from 1970 to 1980. Anyway, the significant discrepency in occupied and vacant households nationally between the 1987 JES and the official estimate from the Bureau of Census indicates that the data collection efforts during the 1987 JES were not successful at counting non-farm households. This large undercount of non-farm households may distort or invalidate the analysis in this report. Therefore, this analysis should not lead to detailed and definitive inferences.

Finally, inspection of the data showed that the analysis was greatly influenced at times by outliers. For example, 50 of the 15,973 segments accounted for 27 percent of the estimated total households in the coterminous United States. The impact of outliers will be addressed in this report.

SCOPE

The analysis will be performed for four different populations to assess the adequacy of the area frame design. The first population evaluated will be the farm population as currently defined by NASS. The second population will include all households - farm and non-farm. The third and fourth populations will be referred to as the rural populations. Two rural populations are easily definable within NASS's current area frame design: one includes all households except those identified in urban areas (or strata) and the second includes all households except those located in urban and ag-urban strata. These strata will be defined in the next section. An evaluation of other kinds of rural populations such as one excluding metropolitan statistical areas is outside the scope of this preliminary analysis.

ANALYSIS PLAN

The analysis will be presented in three sections. First, an overview of the features of NASS's area frames will be provided. Second, basic analysis will be presented relative to the area frame design for the farm and entire populations. The farm population will serve as a benchmark for comparisons to broader populations. Finally, the results of the analysis for the two rural populations will be discussed.

The analysis was conducted at the regional and national levels. Regions were defined the same as the regional definitions used by the Agricultural Statistics Board of NASS when estimating the number of farms. The states included in each region are shown in Table 1.

Table 1. States in each of the Four Regions.

Region	States
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont
South	Alabama, Arkansas, Delaware, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia
Central	Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin
West	Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming

NASS's area sampling frames are stratified into various land uses based on the degree of cultivation and urbanization. Land-use stratification provides substantial increases in the precision of agricultural statistics generated from general agricultural surveys such as crop and livestock surveys. The area sampling frames for the 48 contiguous states have been built over a 20-year period with changing staffs and levels of expertise and sometimes with minor changes in the land-use definitions. For example, urban areas now require at least 100 residences per square mile to be classified in the urban stratum while in the past a minimum of 20 residences per square mile was used. Therefore, land-use definitions are not always identical among all area frames.

In general, there are six broad land-use strata as shown in Table 2. Analysis in this report will be presented for each broad land-use stratum.

Table 2. General Land-Use Strata Definitions for the Area Sampling Frames.

Stratum	Definition
Intensive Cultivation	Land that is 50 to 100 percent cultivated.
Moderate Cultivation	Land that is 15 to 49 percent cultivated.
Minimal Cultivation	Land that is less than 15 percent cultivated, pasture and range land, public and private grazing land.
Ag-Urban	Land that is less than 15 percent cultivated: residential land mixed with agriculture, small cities and towns surrounded by cultivated land.
Urban	Residential/commercial land: no cultivation, large cities and resorts.
Non-Agricultural	National and state parks, wilderness areas, military installations and airports.

The analysis in the sections to follow will:

-- Explore the distributions of the survey total and variance for each of the four populations across regions and land-use strata.

-- Compare the current and optimum area frame sample allocations across regions and land-use strata.

-- Examine the precision levels for the survey totals.

-- Discuss the adequacy of the current area frame design for each population.

AREA FRAME DESIGN

The area sampling frame in each state is stratified by land use. Table 3 shows the distribution of land by stratum and region. Notice that a small percentage of the land is classified as ag-urban, urban, or non-agricultural. Over half of the land area in the coterminous U.S. is in the minimally cultivated stratum with almost one-third of the land being minimally cultivated land in the West region. The West and Northeast regions have the most and least land, respectively.

Table 3. Percent of the Land Area in each Stratum for each Region.

Stratum	Region				
	Northeast	South	Central	West	Total
Intensive Cultivation	1.0	4.7	14.0	3.4	23.1
Moderate Cultivation	1.9	9.4	4.4	2.2	17.9
Minimal Cultivation	2.1	13.4	5.7	31.5	52.7
Ag-Urban	0.3	1.1	0.9	0.4	2.7
Urban	0.1	0.4	0.3	0.1	0.9
Non-Agricultural	0.2	0.6	0.2	1.7	2.7
Total	5.6	29.6	25.5	39.3	100.0

Table 4 shows the distribution of the 1987 area frame sample of 15,973 segments among the land-use strata. About two-thirds of the sample is in the moderately and intensively cultivated strata. The minimally cultivated stratum contains less than 20 percent of the sample but over half the land area (as seen in Table 3). The sample percentages in the ag-urban and urban strata are slightly inflated, as mentioned previously, due to the 308 sample segments retained an extra year for the 1987 JES (12.3 percent compared with 10.6 percent without the additional segments). The most noticeable difference between the distributions of the land area and sample allocation is in the minimally cultivated stratum in the West region (31.5 percent of the land vs. 7.6 percent of the sample). The difference between the sample and land area is also striking in the Southern region due to the larger sample sizes needed to combat the agricultural heterogeneity.

Table 4. Percent of the Sample in each Stratum for each Region.

Stratum	Region				
	Northeast	South	Central	West	Total
Intensive Cultivation	3.2	10.7	18.7	12.7	45.3
Moderate Cultivation	3.1	12.5	3.3	3.5	22.4
Minimal Cultivation	0.9	8.7	1.8	7.6	19.0
Ag-Urban	0.8	4.3	2.3	1.8	9.2
Urban	0.3	1.5	0.8	0.5	3.1
Non-Agricultural	0.1	0.3	0.2	0.4	1.0
Total	8.4	38.0	27.1	26.5	100.0

Another layer of stratification is used in the area sampling frames to improve the precision of the statistics and the dispersion of the sample. This substratification groups agriculturally-similar areas within each land-use stratum. In most cases the substratification is geographic. Substratification of this type has the greatest benefits for agricultural surveys when applied to the more intensively cultivated strata. Its usefulness for agricultural surveys is minimal in non-agricultural areas such as urban centers.

Table 5 shows the average number of substrata in each land-use stratum and region. The greater the intensity of agriculture or cultivation, the greater the number of substrata. Also, notice that more substrata are used in the Central and Southern regions where the agriculture is more intense and diverse, respectively.

Table 5. Average Number of Substrata in each Stratum for each Region.

Stratum	Region				
	Northeast	South	Central	West	Total
Intensive Cultivation	5.0	7.8	10.1	8.6	8.5
Moderate Cultivation	5.2	10.4	6.7	5.2	7.3
Minimal Cultivation	2.5	8.8	4.5	2.0	3.8
Ag-Urban	2.7	5.3	3.9	3.7	4.1
Urban	1.5	2.0	1.4	1.5	1.7
Non-Agricultural	1.0	1.3	1.0	1.3	1.2
Total	3.3	6.0	5.4	3.6	4.7

FARM HOUSEHOLDS AND ALL HOUSEHOLDS

The distributions for the number of farm households and the number of total households and their corresponding sampling variances are presented in Tables 6 and 7 for each region and stratum, respectively. The number of farm households and its variability are concentrated in the Southern and Central regions. On the other hand, total households are more dispersed across regions. The differences between the farm and general populations are much more pronounced across land-use strata. Almost three-fourths of the farm households are in the moderately and intensively cultivated strata while over three-fourths of all households are in the urban and ag-urban strata. This suggests that the area frame design requirements will differ for the two populations.

Over half of the farm variance resides in the urban and ag-urban strata. However, about 94 percent of the urban variance was isolated to Texas and Indiana and about one-third of the ag-urban variance was attributable to Texas. One urban segment with an expanded number of farm households of 13,433 caused the large variance contribution from Indiana (49 percent of the national urban variance). Four urban segments with a combined total of 26,491 expanded farm households contributed to the large variance in Texas (45 percent of the national urban variance). Similarly, several ag-urban segments inflated the ag-urban sampling variance in Texas. Therefore, a few segments have distorted the variance distribution among land-use strata for the farm sector.

Most of the sampling variance for the total number of households is in the urban stratum, which has about half the households but only three percent of the sample. The size of the urban variance was greatly influenced by the

following four states: California, Florida, Minnesota, and New York. These four states had 20 segments that accounted for 13.1 million of the 85.6 million households in the country. These four states were responsible for 75 percent of the national urban variance. Despite their impact, a difference still exists between the farm and general populations concerning the location of sampling variability.

Table 6. Percent of the Farm Households and All Households (Total and Variance) in each Region.

Region	Percent of the			
	Farm Households		All Households	
	Total	Variance	Total	Variance
Northeast	6.6	3.1	17.0	12.3
South	41.6	48.3	35.3	19.3
Central	40.0	40.4	27.0	45.4
West	11.8	8.2	20.7	23.0

Table 7. Percent of the Farm Households and All Households (Total and Variance) in each Stratum.

Stratum	Percent of the			
	Farm Households		All Households	
	Total	Variance	Total	Variance
Intensive Cultivation	43.3	15.8	7.4	0.6
Moderate Cultivation	29.2	16.0	8.1	0.7
Minimal Cultivation	12.0	12.7	4.8	2.0
Ag-Urban	12.1	23.1	30.8	9.4
Urban	3.4	32.4	48.7	87.3
Non-Agricultural	0.0	0.0	0.2	0.0

As mentioned earlier, substratification is used to improve the precision of the crop and livestock statistics. The substrata are formed by grouping agriculturally-similar areas based on crop and livestock data in each county. Table 8 shows that the current substratification has a negligible impact on the precision levels for the number of farm households and all households. This occurs since the count of households is not correlated with the substratification variables. We do know that the operational substratification improves the precision for characteristics about farm households such as crop acreages, but expect the gains in precision to be smaller for characteristics pertaining to the entire population.

Table 8. Coefficient of Variation for Farm Households and All Households in each Stratum with or without Substrata.

Stratum	Coefficient of Variation (%)			
	Farm Households		All Households	
	With Substrata	Without Substrata	With Substrata	Without Substrata
Intensive Cultivation	1.4	1.5	4.3	4.4
Moderate Cultivation	2.2	2.3	4.3	4.4
Minimal Cultivation	4.7	4.8	12.0	12.2
Ag-Urban	6.3	6.5	4.1	4.2
Urban	26.1	26.2	7.9	7.8
Non-Agricultural	69.0	69.0	58.0	58.0

For the general population, another layer of substratification would be advised to reduce the huge urban contribution to the overall variance. This substratification would likely be based on a factor such as the population density or the kind of housing units. Also, if sample sizes permit, more geographic substrata in the ag-urban and especially the urban strata should be beneficial. No changes would be needed with the current substratification in the intensively, moderately , and minimally cultivated strata where the variance is small.

A univariate optimum sample allocation for each population was compared with the current allocation to determine what shifts in the sample allocation might be justified. The following three constraints were placed on the allocation algorithm:

(1) Each stratum in a state must have at least two sample segments for computing the variance,
(2) A stratum in a state cannot have more than 300 sample segments due to budget and data collection considerations and to reduce the

impact of outliers on the allocation, and

(3) The sampling rate for a stratum in a state must be no smaller than 1 in a 1000 segments to prevent extremely large expansion factors that can lead to outliers that distort the survey results.

As shown in Table 9, the optimum allocation for farm households approximately doubles the number of sample segments in the urban and ag-urban strata. This change, however, is due partially to Texas where the allocation calls for the maximum allowable 600 segments in the urban and ag-urban strata. In practice, we would not shift some of the sample into these strata to improve the estimate of farm households since the more important crop and livestock statistics would suffer simultaneously. Also, Table 11 shows that the number of farm households can be estimated very precisely under the current sample allocation. Therefore, nationally, the sample distribution among strata is currently satisfactory for farm households.

Table 9. Percent of the Sample in each Stratum for the Current Allocation and for the Optimum Allocations for Farm Households and All Households.

Stratum	Sample Allocation (%)		
	Current	Optimum	
		Farm Households	All Households
Intensive Cultivation	45.3	35.6	16.7
Moderate Cultivation	22.4	24.9	13.5
Minimal Cultivation	19.0	17.1	10.3
Ag-Urban	9.2	15.9	32.4
Urban	3.1	5.9	26.2
Non-Agricultural	1.0	0.6	0.9

The optimum sample allocation for the general population is strikingly different from the present allocation (see Table 9). As expected, there is a sizeable shift in the sample away from the cultivated strata to the urban and ag-urban strata (59 percent of the sample). The shift would not have to be as drastic in practice if an improved substratification scheme was developed to reduce the variance in the urban and ag-urban strata and if robust estimation procedures were used to handle outlier data. Still, the analysis supports a larger sample in the urban and ag-urban strata to survey the general population properly. Table 10 shows that the Northeast region would be the region most affected by the sample reallocation.

Table 10. Percent of the Sample in each Region for the Current Allocation and for the Optimum Allocations for Farm Households and All Households.

Region	Sample Allocation (%)		
	Current	Optimum	
		Farm Households	All Households
Northeast	8.4	6.6	15.4
South	38.0	44.4	35.3
Central	27.1	32.7	27.0
West	26.5	16.3	22.3

Finally, the coefficients of variation (C.V.'s) for total households using the current and optimum allocations are shown in Table 11. The national C.V. of 4.1 percent would be conservative if the improvements already mentioned were made to the current area frame design. Naturally, a sample reallocation would be very useful in reducing the C.V.'s even further for characteristics about the general population. Without a sample reallocation, precise national estimates for the general population (C.V.'s of about 5 percent) would probably only be achievable for some "major" survey items where "major" survey items are items that have positive responses for a high percentage of the sample segments. With a sample reallocation, more survey items would have precise national estimates. Items that have positive reponses for a small percentage of the sample segments would not be estimated precisely.

Table 11. Coefficient of Variation for Farm Households and All Households in each Region and in the 48 States Based on the Current and Optimum Allocations.

Region	Coefficient of Variation (%)			
	Farm Households		All Households	
	Current	Optimum	Current	Optimum
Northeast	4.2	3.8	8.2	2.4
South	2.8	1.8	5.1	1.9
Central	2.6	1.6	10.3	1.9
West	4.0	3.4	9.3	2.9
48 States	1.6	1.1	4.1	1.1

RURAL HOUSEHOLDS

Another population that NASS may be asked to survey in the future is the rural population; that is, something broader in scope than the farm sector but not involving the entire population. An immediate problem is to define what is meant by rural America. Is "rural" defined by geographic location, population density, exclusion of metropolitan statistical areas, or by all land except large cities?

A simple definition of rural that is within the framework of NASS's area frame design is to include all land except land stratified into the urban stratum. This would eliminate approximately half of the households in the country. The urban stratum includes land in the inner cities where no cultivated land is present.

Small, rural cities and densely-populated areas bordering cultivated land are often stratified by NASS as ag-urban rather than urban since some agricultural activity such as cattle raising might exist in the area. For example, the location of the Area Frame Section in Fairfax, Virginia is stratified as ag-urban since cattle are located within one mile of the office. However, few people would view Fairfax as rural. Therefore, a second rural definition will be considered which excludes both urban and ag-urban land. This decision would limit the rural population to about 20 percent of the total population.

Table 12 displays the distributions of the survey total and variance by region for the two rural definitions. About two-thirds of the rural population for each of the two definitions belongs to the Southern and Central regions. The location of the data variability, however, is much different for the two rural definitions. The second rural definition resulted in considerably more variability in the West region and less variability in the Central region. It will be seen in the next paragraph that much of this difference can be explained by a few segments.

Table 12. Percent of Rural Households (Total and Variance) in each Region for the Two Rural Definitions.

Region	Percent of the Rural Households			
	Excluding Urban		Excluding Urban and Ag-Urban	
	Total	Variance	Total	Variance
Northeast	18.0	14.4	19.6	10.0
South	39.1	22.6	43.0	25.0
Central	26.2	34.5	20.7	8.1
West	16.7	28.5	16.7	56.9

Table 13 shows that the majority of the estimates for the total and variance is in the ag-urban stratum for the first rural population. These percentages are inflated greatly by six ag-urban segments in three states (California, Illinois, and Indiana) that expanded to 1.5 million households. These three states were responsible for 40 percent of the ag-urban variance nationally. The distribution across strata for the second rural population is more similar to the farm population (refer back to Table 7). Therefore, this population would be easier to accommodate within the current area frame design. The large variance contribution for the second rural population in the minimally cultivated stratum is caused mostly by a single segment in California that had an expanded number of households equal to 438,065 and the corresponding stratum contained about 80 percent of the national variance in the minimally cultivated stratum. Therefore, this segment greatly distorted the variance distribution shown in Table 13 for the second rural population.

Table 13. Percent of Rural Households (Total and Variance) in each Stratum for the Two Rural Definitions.

Stratum	Percent of the Rural Households			
	Excluding Urban		Excluding Urban and Ag-Urban	
	Total	Variance	Total	Variance
Intensive Cultivation	14.5	4.7	36.3	18.1
Moderate Cultivation	15.8	5.7	39.6	21.9
Minimal Cultivation	9.3	15.3	23.3	58.5
Ag-Urban	60.1	73.9	--	--
Urban	--	--	--	--
Non-Agricultural	0.3	0.4	0.8	1.5

As expected, the optimum sample allocation for the first rural population calls for a sample shift to the ag-urban stratum (see Table 14). If improvements were made to the stratification design in the ag-urban stratum, then we would not need to shift as much of the sample to the ag-urban stratum as indicated in Table 14. The optimum allocation for the second rural population would have called for a larger share of the sample in the minimally cultivated stratum than shown in Table 14 had the algorithm not restricted the maximum sample size for a stratum in a state to 300 segments. If this restriction was lifted, the allocation would call for 1,433 segments for the minimally cultivated stratum in California where the outlier segment occurred. Some movement in the sample from the intensively to moderately cultivated strata also occurred for the second rural population.

Table 15 shows the distributions of the current and optimum sample allocations by region for the two rural populations. This table shows that the largest change in the sample allocation would occur for the Northeast region.

Table 14. Percent of the Sample in each Stratum for the Current Allocation and for the Optimum Allocations for Rural Households.

Stratum	Sample Allocation (%)		
	Current	Optimum	
		Excluding Urban	Excluding Urban and Ag-Urban
Intensive Cultivation	45.3	22.4	40.1
Moderate Cultivation	22.4	19.2	34.4
Minimal Cultivation	19.0	14.0	24.0
Ag-Urban	9.2	43.4	--
Urban	3.1	--	--
Non-Agricultural	1.0	1.0	1.5

Table 15. Percent of the Sample in each Region for the Current Allocation and for the Optimum Allocations for Rural Households.

Region	Sample Allocation (%)		
	Current	Optimum	
		Excluding Urban	Excluding Urban and Ag-Urban
Northeast	8.4	15.9	14.7
South	38.0	39.2	43.6
Central	27.1	23.3	19.2
West	26.5	21.6	22.5

Finally, the C.V.'s under the current and optimum sample allocations are presented in Table 16 for the two rural populations. The C.V.'s under the current allocation are smaller than the C.V.'s for the entire population (refer to Table 11). To the contrary, the C.V.'s under the optimum allocation are larger than the C.V.'s for the entire population, partially because of the few outlier segments discussed previously. About 17 percent and 31 percent of the total variances from the optimum allocation for the first and second rural populations, respectively, came from the minimally cultivated stratum in California that had the very atypical segment.

If robust procedures were developed to handle outlier segment data and the stratification design was improved for the ag-urban stratum, then one would expect precise national estimates for some major survey items pertaining to the rural population. Precise national estimates would be achievable for more survey items if a sample reallocation was performed.

Table 16. Coefficient of Variation for Rural Households (Using the Two Rural Definitions) in each Region and in the 48 States Based on the Current and Optimum Allocations.

Region	Coefficient of Variation (%)			
	Excluding Urban		Excluding Urban and Ag-Urban	
	Current	Optimum	Current	Optimum
Northeast	6.2	2.7	6.0	4.1
South	3.5	2.2	4.4	3.1
Central	6.5	3.0	5.1	6.1
West	9.5	5.3	16.9	10.6
U.S.	2.9	1.5	3.8	2.7

CONCLUSIONS AND RECOMMENDATIONS

A preliminary evaluation was performed to assess the suitability of NASS's area frame design for conducting household surveys for the entire population or the rural population. This evaluation restricted itself to two rural definitions that are easily definable within the current area frame design. The analysis was influenced greatly by a handful of atypical segments, was restricted in depth since only a count of households could be evaluated, and was hindered by a significant undercount in total households. Therefore, detailed conclusions will not be drawn from the analysis. Before detailed inferences can be stated, data on more characteristics about the various populations should be analyzed and the screening procedures used by NASS to identify non-farm households should be improved. A small-area study would be beneficial to develop improved procedures for identifying non-farm households.

The analysis indicated that precise national estimates are attainable for major characteristics pertaining to the rural or entire population. Another layer of substratification should be considered to divide the urban stratum into more homogeneous areas, e.g. stratify based on population density. If sample sizes permit, more geographic substrata should be created in the ag-urban stratum and especially in the urban stratum to improve the precision of the estimates. Also, an increase in the number of sample segments would be necessary in the urban and ag-urban strata. Finally, robust estimation procedures should be developed to deal with the influential effect of outliers.

The next phase of evaluating NASS's area frames for surveying rural America will explore defining the rural population to include all land except land classified as metropolitan statistical areas (MSA's). Definitions of MSA's are issued by the Office of Management and Budget (OMB) for use in the presentation of statistics by agencies in the federal government. OMB establishes the definitions of MSA's following criteria developed with the advice of the Federal Committee on Metropolitan Statistical Areas, which is composed of representatives from the major federal statistical agencies.

REFERENCES

[1] Matthews, R.V. (1988): Screening Residential Tracts for Agricultural Activity. U.S. Department of Agriculture, National Agricultural Statistics Service, Staff Report Number SSB-88-05. Washington, D.C.

[2] Tortora, R.D. (1987): A Memorandum to Jack Nealon Dated June 24, 1987. U.S. Department of Agriculture, National Agricultural Statistics Service. Washington, D.C.

[3] U.S. Department of Commerce (1987): Current Housing Reports -- Housing Vacancies. Bureau of Census. Washington, D.C.