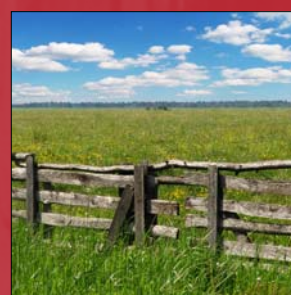


IMPROVING INFORMATION ABOUT AMERICA'S FARMS & RANCHES



A REVIEW OF THE CENSUS OF AGRICULTURE

THE COUNCIL ON FOOD, AGRICULTURAL AND RESOURCE ECONOMICS

IMPROVING INFORMATION ABOUT AMERICA'S FARMS & RANCHES



A REVIEW OF THE CENSUS OF AGRICULTURE

Coordinated by the
Council on Food, Agricultural
and Resource Economics

Washington, DC | March 2007



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The panel's task was made easier by excellent assistance from the C-FARE office. Tamara Wagester, C-FARE Executive Director, arranged all the panel meetings, conference calls and financial matters, while maintaining a constant stream of communications and services to the panel. Mikael Pyrtel, C-FARE intern, systematically recorded the panel's deliberations, summarized presentations by external stakeholders and researched a number of issues for the panel.

Thomas D. Rowley served as the very capable general editor of the report. Colleen Clancy McGinley provided graphic design and layout. NASS assumed responsibility for printing and distributing the report.

Three individuals chosen for their technical expertise and perspectives on the COA reviewed the report in draft form. The purpose of these independent reviews was to provide candid and critical comments to help make the report as sound as possible and to ensure that it meets accepted standards for objectivity, evidence and responsiveness to the charge. We wish to thank Bruce L. Gardner, Department of Agricultural and Resource Economics, University of Maryland; Tapabrata Maiti, Center for Survey Statistics and Methodology, Iowa State University; and Ray D. Bollman, Research and Analysis, Agriculture Division, Statistics Canada, for providing timely and independent external reviews. Although these individuals provided constructive comments and suggestions, responsibility for the final content of this report rests entirely with the panel.

Panel members deserve special commendation for their outstanding work under tight deadlines. Representing diverse disciplines and backgrounds, the panel members came together quickly to function as a team. They gave their time, energy and expertise to make this an insightful and useful document that will assist NASS in improving the procedures and outputs of the COA to the benefit of the American public.

In closing, we wish to acknowledge the leadership and organizational skills of John E. Lee, Jr., who served as Review Director. John kept the panel on task and on schedule with pleasant reminders and guiding questions. His knowledge of U.S. agriculture and appreciation for the value of the relevant data provided by the COA contributed immensely to this review.

A. Gene Nelson, Chair
Jerald J. Fletcher, Vice-Chair
Panel to Review the Census of Agriculture
March 1, 2007



CHARGE TO THE REVIEW PANEL

In May 2006, the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS) asked the Council on Food, Agricultural and Resource Economics (C-FARE) to assemble a panel of expert social scientists from academia, government and the private sector to conduct an "independent, comprehensive and objective review of the Census of Agriculture."¹ The purpose of the review is to identify the strengths and weaknesses of the Census of Agriculture (COA) and to recommend changes to make it both more accurate and more useful. Implicit in that purpose are two questions: 1) Is NASS doing things right? 2) Is NASS doing the right things? The first question relates to technical issues involved in the collection, processing and dissemination of COA data. The second is much broader and relates to the rationale and aim of the COA, e.g., the universe(s) targeted; the kinds of data collected; and the content, form and accessibility of data products produced. To answer those questions, the review looked at the full range of COA activities—from planning and implementation to analysis and publication of results.

The following areas were identified by NASS as specific areas of focus for the review:

- Target population and response;
- Census content development;
- Sampling, data processing and documentation of methods; and
- Census output products.

Each sub-panel then prepared a topic-area report containing its evaluation and recommendations. Those topic-area reports are Chapters 7-10. That division of labor notwithstanding, all evaluation and recommendations contained in this report represent the consensus of the entire panel. Finally, in the course of its work, the panel examined several themes and generated several recommendations that either cut across the four areas of focus or pertain to more than one. These "general or cross-cutting" recommendations are reported separately.

For its part, NASS provided the review panel with data and information requested, but did not in any way intervene in the panel's deliberations. NASS also gave the panel the freedom to consider issues not specifically included in the charge, but at the same time made clear that the Agency is constrained in its ability to respond to recommendations on issues outside the scope of the review. For example, NASS is not at liberty to change the official definition of a farm, as that definition is established at higher policy levels in the executive and legislative branches of the U.S. government. Likewise, NASS is limited in its ability to enact recommendations pertaining to so-called "follow-on surveys" that supplement information collected by the COA and provide more in-depth information on specific topics such as irrigation, land ownership, aquaculture and horticulture. That limited ability stems from the uncertainty of funding to conduct the supplemental surveys, as well as the different procedures involved in conducting surveys versus the COA. Finally, NASS committed to publish the report without alteration or comment and make it available to the public.

Because the COA is conducted every five years to cover calendar years ending in "2" and "7" (e.g., 1997, 2002, 2007), the recommendations contained here focus on the 2012 COA, for which the planning cycle begins in 2007.



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EXECUTIVE SUMMARY

Background and Overview

In May 2006, the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS) asked the Council on Food, Agricultural and Resource Economics (C-FARE) to assemble a panel of experts to conduct an "independent, comprehensive and objective review of the Census of Agriculture." NASS asked the panel to focus on two questions regarding the Census of Agriculture (COA): 1) Is NASS doing things right? 2) Is NASS doing the right things? The first question relates to technical issues involved in the collection, processing and dissemination of COA data. The second is much broader and relates to the rationale and aim of the COA. To answer these questions, the review looked at the full range of COA activities—from planning and implementation to analysis and publication of results.

For its part, NASS provided the review panel with data and information requested, but did not in any way intervene in the panel's deliberations. NASS also gave the panel the freedom to consider issues not specifically included in the charge, but made clear that the Agency is constrained in its ability to respond to recommendations on issues outside the scope of the review. Finally, NASS committed to publish the report without alteration or comment and make it available to the public.

Conducted every five years, the COA is a widely used source of data describing the nation's production agriculture sector. It involves multiple phases—from planning and testing to data collection, analysis and publication. In conducting the COA, NASS faces myriad challenges, both technical and conceptual. Chief among those challenges is dealing with a wide range of often-competing uses and demands for COA data, the ever-changing nature and structure of the agricultural sector, the dramatic changes in information technology and the resource constraints inherent in governmental efforts.

To accomplish its work of reviewing such a wide-ranging effort as the COA, the panel divided the task into four separate areas of focus and assigned each to a sub-panel:

- Target population and response;
- Census content development;
- Sampling, data processing and documentation of methods; and
- Census output products.

Each sub-panel then prepared a topic-area report containing its evaluation and recommendations. Those topic-area reports are contained in the report as Chapters 7-10. That division of labor notwithstanding, all evaluation and recommendations contained in this report represent the consensus of the entire panel. The panel also examined several themes and made several "general or cross-cutting" recommendations that either fall outside the four areas of focus or pertain to more than one. All recommendations are intended to help NASS as it prepares for the 2012 Census and beyond. (Note: Many of the recommendations are accompanied by "strategies for implementing" them. These are listed in the body of the report.)

General and Cross-cutting Recommendations

Dramatic changes in the organization and management of agriculture, new opportunities and challenges imposed by revolutionary changes in information technology, the impending retirement of many NASS staff and the reallocation of already-limited statistical research resources to meet needs of current operations all argue for major new investments in NASS's human capital, research capacity and access to supplemental expertise. Without such an investment, the quality and relevance of the COA and NASS's other statistical activities will quickly erode. The planning period for the 2012 COA, which begins in 2007, is the critical time for such investment.

RECOMMENDATION 6.1

NASS should access a panel of agricultural experts to evaluate implications for the COA of the rapidly changing and restructuring global agri-food system. The growing complexity of the agricultural sector creates challenges for identifying and surveying farms, determining the relevant unit(s) of observation, determining the relevant data for understanding the sector, distinguishing between production and marketing activities, providing the data and services users want and need and more. To understand and address this complexity—and ensure that COA data continue to be accurate and relevant—NASS should assemble experts from academia, government and the private sector to examine these structural changes and their implications.



RECOMMENDATION 6.2

Prior to the 2012 COA, NASS should expand the application of information technology consistently throughout the process—from online survey response to data processing and user-friendly data products. Developing user-friendly web questionnaires, state-of-the-art and efficient processing and a new generation of user-friendly data products may be the greatest near-term challenge for NASS and the COA. Because the challenge is common to other statistical agencies and too large to handle alone, NASS should partner with those agencies to muster and finance the expertise needed.

RECOMMENDATION 6.3

NASS should invest in additional research capacity to help redesign survey instruments and products, adopt new methods for statistical analysis, manage the potential of new information technology and increase transparency of data characteristics. Current COA research staff, while highly qualified, is small and must service all NASS statistical programs. Adding resources required to address the research needs identified by this review must be a high priority. Without sufficient resources for adequate research, the quality of the COA will deteriorate, undermining its usefulness to all users. Until such resources are secured as permanent staff, NASS may need to find alternative ways to rebuild its staff.



RECOMMENDATION 6.4

NASS should expand its commitment to transparency in all aspects of the COA and make that transparency replicable and user-friendly. The need for transparency cuts across all steps of the COA process. Data users need information on all aspects of the data collection operations, processing, coding, weighting, imputations and other characteristics of the data to assess its usefulness, appropriateness and interpretation.

RECOMMENDATION 6.5

NASS should make its research more available to the statistical community for timely peer review and comments. NASS should also consider forming an external statistical/technical consultation panel. While some NASS research is published in peer-reviewed journals and some research

papers are presented at professional meetings, making this standard practice would add discipline and rigor to the research and would enhance the professional reputation of NASS and its staff. In the process, NASS would increase its exposure to leading-edge statistical thinking and enhance the professional exposure of its staff. An external panel would increase access to additional statistical expertise.

RECOMMENDATION 6.6

NASS should balance all its COA activities to assure the most effective and efficient use of resources. This includes weighing the marginal costs of adding farms to the list frame versus improving other aspects of the COA. It also includes the possibility of shifting from the questionnaire to sample surveys those data items that do not need to be fully enumerated for all farms and ranches. The review highlighted several situations where trade-offs need to be assessed and priorities established to assure the most effective use of available resources. In the logical extreme, all COA expenditures should be examined to determine where the marginal dollars buy the greatest payoff. The intent of this recommendation is to intensify current efforts by NASS toward greater efficiency in resource use.

RECOMMENDATION 6.7

NASS should incorporate product design into the overall COA planning process, including incorporating more value-added data products into the process for finding farms and generating higher response rates. The components of the COA process should be considered integral parts of a total system that begins with the desired products and works backwards. A well-defined package of data products can improve efficiency in data processing. Likewise, data products can be designed to improve participation in the census. This implies a stronger role for product designers in the overall COA planning process.

Target Population and Response

The COA defines a farm—and thus its target population—as any place from which \$1000 or more of agricultural products were produced and sold or normally would have been sold during the Census year.

This definition has been applied since 1974 and strong political reasons argue against changing it. The definition does, however, create significant challenges for NASS in finding its target population and getting it to respond and respond accurately to the COA. Large, traditional farms are easier for NASS to find than smaller, non-traditional farms. Many such “farms” are operated by persons who do not consider themselves farmers and who have little contact with agencies and organizations from whom NASS obtains information to build lists. This is especially true for very small farms, farms operated by minorities and women and so-called “lifestyle” farms. Likewise, many such farms—if they do receive the COA questionnaire—do not respond because they think it does not apply to them or because it represents too much of a burden. Consequently, while the overall coverage rate of farms in the 2002 COA was 79 percent, coverage of female- and minority-operated farms was much lower. To justify the additional expenditure for improving coverage of the latter group, NASS needs to develop a clear statement of the value of having better public information for this group. The following recommendations propose cost-effective ways to improve coverage and the quality of responses obtained.

RECOMMENDATION 7.1

NASS should continue partnering with other organizations to increase COA coverage, especially of farm types that currently have low coverage levels. NASS has long collaborated with others to improve its list frame and to generate improved response from farmers. However, NASS could more effectively, and at relatively low cost, use select agencies, organizations and educators already working with farmers—especially under-represented farmers. Cooperative Extension Service personnel are in all counties and know the local people. Local and community-based organizations work with Black, Hispanic, Native American and other minority groups. NASS could use specialized educational and training materials with these organizations and individuals to improve awareness of the COA and its importance. Likewise, several federal agencies with programs targeted to small and minority-operated farms could share information with NASS. All such sharing must be consistent with privacy laws and regulations.

RECOMMENDATION 7.2

NASS should continue testing the Agricultural Identification Survey to assure adequate information to identify farms for the list frame, while not discouraging increased cooperation and participation in the COA. NASS uses an Agricultural

Identification Survey (AIS) as a screener to identify farms for inclusion on its list frame prior to each Census. The length and complexity of the 2007 AIS, however, might discourage response to the AIS and, later, to the COA. NASS should carefully evaluate the 2007 AIS experience for possible adjustments to the 2012 AIS.

RECOMMENDATION 7.3

NASS should develop and utilize public relations strategies to improve participation rates. (See *Recommendation 10.3.*) NASS’s success in reaching farms, especially minority-operated and small farms, and getting them to respond would likely be improved with an enhanced public relations strategy that addresses language barriers, uses specialized media to target under-represented groups, uses trusted community spokespersons and provides resources and assistance to community-based organizations that can demonstrate to their communities the value of the COA.

RECOMMENDATION 7.4

NASS should take stronger steps to promote the use of the web as a mode of response. As the use of computers and the Internet grows, people will increasingly accept and even prefer responding to census-type surveys electronically. Electronic responses can have built-in accuracy and completeness checks. They can improve speed and efficiency of data processing. NASS, which is aware of the potential and experimenting with electronic responses for the 2007 COA, should carefully evaluate the experience and make appropriate adjustments for the 2012 COA.

Census Content Development

The act transferring the COA to USDA provides little guidance with regard to its scope or the data to be collected—that is, the content of the COA. Nevertheless, certain data are required to meet other legal mandates as well as policy and programmatic needs. Still other data are demanded by myriad, and often-competing, users. To satisfy these demands, the COA aims to provide a complete and comprehensive picture of American agriculture. And while the current COA does that—and does it well—an evolving agricultural sector necessitates ongoing revision. To ensure its relevance and utility, the COA must not only react to changes, it must anticipate them. And it must do so while dealing with constraints placed on it by budget, regulations on respondent burden and the practical limits of respondents’ time and patience.

RECOMMENDATION 8.1

NASS should develop a comprehensive and transparent system for evaluating the content of the COA questionnaire, including adopting criteria that recognize the unique values of a complete enumeration of all farms, as compared to sample surveys. While the criteria currently used by NASS to evaluate Census content have merit, there is nothing inherent in them that require the data to be collected by the COA, as opposed to other surveys. NASS needs a more rigorous set of criteria, focused on two questions: “Why are the data needed?” and “Why should the data in question be collected by the Census?” The first question must be addressed by examining who will use the data, what decisions will be informed with the data and what value can be attached to improved decisions because of the availability of the data. The question about whether the Census is the proper vehicle for collecting the data must be answered by testing the data items requested against a set of criteria, two of which are: “Is the data item needed for all farms (i.e., is geographic detail needed)?” and “Are the data needed on the Census so they can be cross-tabulated with other data?” All suggestions for Census content should be tested against these and other criteria suggested in Chapter 8. In short, the process should be better documented and made more systematic and transparent.

RECOMMENDATION 8.2

NASS should evaluate information collected in the COA about farms and farm operator households for relevance to the business of farming and for responsiveness to changing needs of users. The primary focus of the COA should be on agriculture as an economic sector. The primary data collected, therefore, should be number of farms, inputs purchased, costs of inputs, outputs produced and output value. But to understand the economics of the sector, further information is needed on who is farming and how they are connected to the sector. That encompasses the whole range of operators—from large, complex businesses to so-called “lifestyle” farmers. Furthermore, in presentations before the review panel, stakeholders expressed their desires for more data on marketing, production and environmental practices, government payments, farm



labor and geo-referenced data. These “desires” must be evaluated against the basic purposes of the Census and whether it is the proper vehicle for collecting the desired data.

RECOMMENDATION 8.3

NASS should take the lead to organize a Federal interagency committee to research how government agencies might develop a standard system of individual farm identification while protecting farmer confidentiality. Other surveys, by other agencies, also collect data on farms and farm households. These efforts may be duplicative. For example, how many times is it necessary to ask for the income category of the farm family? The key to assigning meaning to farm-based data is to identify the “farm” with which they are associated. However, there is no uniform method of identifying the farm of interest for more than the survey at hand. The potential complexities of this task may require a significant research investment up front, with special emphasis on avoiding any possibility for compromising the confidentiality of individual farm data.

RECOMMENDATION 8.4

NASS should continue using follow-on and other sample surveys to expand the limited nature of the COA. So-called “follow-on” and other sample surveys supplement the COA and can be an efficient way of collecting data that are important but for which complete enumeration is neither required nor necessary. If any of the existing sample surveys

were to be discontinued, the ability to describe and analyze the economic profile of the agricultural sector would be severely reduced. Thus, NASS should promote the sample surveys as part of the total Census program, meaning that approval of funding for the Census should include approval of the total package of surveys.

Sampling, Data Processing and Documentation of Methods

The more technically complex aspects of the COA are the use of area sampling to cover farms missed on the Census Mailing List (CML), response adjustments and data editing during processing. NASS made major efforts to improve its processes in these areas for the 2002

COA, the most ambitious being the adoption of new software and hardware for data processing and summarization. NASS encountered problems, but the agency's thorough and candid evaluation of those problems is proving invaluable for the 2007 COA. To aid in this, the panel makes these general recommendations: follow best practices for compiling and editing data; test and compare alternative imputation and estimation methods; thoroughly document all procedures and stay abreast of state-of-the-art statistical methodology and information technology.

The panel also suggests 1) that the CML and area samples remain fully independent if the area frame is to be used to estimate the completeness of the CML; 2) that, in adjusting for under-coverage, NASS take care in separating under-coverage errors from other sources of bias in the data and 3) that NASS not assume that an area frame is complete and correct.

RECOMMENDATION 9.1

NASS should re-evaluate its coverage adjustment procedures and how the need for coverage adjustment might be reduced. NASS should

1) develop a "total error" model based on 2007 COA data for use in estimation procedures; 2) investigate why farms operated by minorities or young people are less likely to appear on the CML; 3) explore alternatives to the current area-sampling scheme to capture more minorities and younger operators; 4) consider dual-system estimation to estimate under-coverage and make coverage adjustment and 5) investigate potential coverage issues arising from new and exiting farms.

RECOMMENDATION 9.2

NASS should continue to improve its procedures for area-frame sampling. This involves refining modeling efforts with respect to geography and targeting strata that are intensely agricultural and those not agricultural when allocating the area sample. Because it appears that the farm operators in the hard-to-capture groups are located in non-intensely agricultural areas, this strategy should allow farms not likely to be on the CML to be captured. NASS should also confirm that the serpentine method for identifying counties in the area frame is the most efficient method.

RECOMMENDATION 9.3

NASS should continue to explore improved methods for adjusting for non-response. This recommendation summarizes four, more specific, recommendations. NASS should 1) consider alternative methods for forming the non-response weighting classes to minimize the bias; 2) follow up with a sample of cases

that do not respond to the 2007 COA to determine how many are farms; 3) explore modeling the probabilities that such cases are farms and using those probabilities in the non-response weighting and 4) follow up in person to a sample of cases with undeliverable addresses in the 2007 COA, thus, permitting an estimation of the number of farms among them.

RECOMMENDATION 9.4

NASS should continue to refine Census editing procedures based on evaluation of experiences with the 2007 COA. NASS has a multi-component editing system to ensure the quality and consistency of data reported on individual Census forms. While this system substantially improves the quality of final data products, further improvements are needed with respect to the efficiency of the editing operations and the amount of analyst interaction in the editing system. Costs of the edit operations are not apparent, and information about the editing processes is not easily available to data users. Therefore, NASS should evaluate the components of the editing system, including the costs and benefits of manual versus machine-based editing. Minimizing human interaction should increase efficiency and reduce costs and, thus, should be a priority for NASS.

RECOMMENDATION 9.5

NASS should increase and broaden its research on item-level imputation. (This is a component of Recommendation 6.3.) For some data items, a high percentage of entries requires imputation. Information about imputations should be made available to data users, who may assume that all data are "facts" provided by the farmers. For data items heavily dependent on imputations, the questions should be evaluated to determine whether they should be reworded to improve response or eliminated.

RECOMMENDATION 9.6

NASS should provide documentation so that all aspects of data collection and compilation are transparent and replicable. (See Recommendation 6.4.) NASS should improve documentation and transparency in all aspects of survey operations, data processing and statistical estimation so that users better understand the data, thus reducing inappropriate interpretations. Such documentation should describe the methods used and provide summary statistics on incidence of data editing, imputation and suppression with the goal of improvements. This information could be made available to the public by providing links to NASS websites.

Census Output Products

The object of all the effort and taxpayer funds expended on the COA is the final package of products. Planning for these products should therefore be integral to the entire COA process. The information age provides new opportunities to make COA data and information more readily available and more useful. Despite the advances in computer technology and computer literacy of users, the digital divide will still be present in 2012 as some COA data users will still prefer paper copies. NASS can increase public awareness of the value of data generated by the COA with a more effective program of marketing and public information.

RECOMMENDATION 10.1

NASS should undertake a comprehensive re-conceptualization of data products and services that anticipates information-technology capabilities and interests of users by 2012. (See *Recommendation 6.2.*) Meeting the requirements of computer-literate users justifies a focus on Internet products. Those who prefer paper copies should expect to be able to print out versions identical to, or easily derived from, the Internet products. A re-conceptualization of COA data products and services will enhance their value to users, build a stronger support base and support the use of Census products to reach potential respondents. Systematic tracking of the uses of Census data is critical to guide effective content and product planning.

RECOMMENDATION 10.2

NASS should place primary emphasis upon designing output products that respond to user demand. (See *Recommendation 6.7.*) In designing products, NASS must evaluate user needs for data and the ways users wish to retrieve and organize the data. Strategies include conducting a series of focus group meetings among major Census users and surveying potential users and stakeholders to determine the key products they desire, expectations about data, formats and best vehicles for data release. Building strategic alliances with stakeholders, including the agribusiness sector, would help demonstrate the utility of the Census.

RECOMMENDATION 10.3

NASS should develop an ongoing communication strategy that keeps COA in the news. (See *Recommendations 6.7 and 7.3.*) A well-designed, ongoing, marketing campaign using fact sheets, news releases, profiles and the like will pique interest among the public and press and highlight the importance of the COA. Integrated into the overall data-gathering process, an

ongoing strategy of data analysis and public releases would show the importance of the data and provide evidence to respondents to improve participation rates and coverage. Rather than an event that occurs once every five years, the Census should be seen as an ongoing opportunity to raise public awareness about American agriculture. The theme, “Your voice, your future and your responsibility,” should be reinforced in all Census-related media.

Conclusion

As context for the review, the panel examined a number of major questions and mega-trends pertinent to the Census of Agriculture. A rapidly changing agricultural sector raises questions about the target population for the Census and what data can and should be collected. There continue to be dramatic changes in information technology that pose both opportunities and challenges to reaching respondents, processing data and designing output products. Users and potential users are demanding more and better data and more flexibility in how the data can be organized. This emphasizes the need for more transparency regarding data characteristics and processing methods, as well as clear and documented criteria for prioritizing the content of the Census questionnaires. Likewise, criteria are needed for determining whether specific data items should be collected via the Census or via Census follow-on sample surveys, ARMS or other sample surveys. NASS should view and manage all these surveys as optional data collection vehicles.

Dealing with these and other issues will require a significant strengthening of NASS’s research capacity and access to expertise. It will also require strengthening partnerships with other agencies and organizations. In short, dealing with the convergence of dramatic changes in agriculture and technology and public demands for improved data products and transparency will be an important challenge to NASS management as it plans for the 2012 Census and beyond.

The Agency’s response to these challenges will determine the relevance, usefulness and, perhaps, even the survival of the Census of Agriculture. The review panel believes that NASS has the will, competence and commitment to respond—to do the right things and to do them right. The time to begin, however, is now—learning as much as possible from the 2007 Census to improve the process for 2012. The success of this review will be measured by the extent to which it helps NASS in that endeavor.



Part I:

Background and Overview

CHAPTER I

Historical Perspective²

The Constitution mandates a census of the population every decade for the purpose of allocating representation in Congress. The first such census was conducted in 1790, and subsequent counts have been taken at the beginning of every decade. When the population census was initiated, the U.S. economy was predominantly agrarian. Over time, however, the economy changed and grew and so, too, did interest in collecting information on it. Thus, in 1840 the economic censuses were born as separate schedules of the population census focused on manufactures and trades, mining, commerce, navigation and agriculture.

Today, the Census of Agriculture (COA) is taken every five years for years ending in “2” or “7.” It is the only source of statistics for U.S. agriculture that provides comparable numbers at the county level, classifying farms by size, tenure, type of organization, principal occupation and age of operator, combined government payments and value of products sold. The 2002 COA covered farm operations in the fifty states as well as Puerto Rico, American Samoa, Guam, Northern Mariana Islands and the U.S. Virgin Islands. Not surprisingly, it has a large and diverse set of users.

It also has a somewhat contentious history—as do the other censuses. First, there is cost. The Bureau of the Census has long faced difficulty convincing Congress that each population census will logically and inevitably cost more than the previous census. Not only does the U.S. population grow significantly over each decade, but, in an industrial country with increasing productivity and growing capital intensity, the unit cost as well as the size of the Bureau’s enumerative labor force increases as well. Even in a high-tech era, taking a census is very labor intensive. This has led to serious budget conflicts in the Congress as deadlines for the decennial population census arrive and the reality of the cost of another census must be faced. This conflict is exacerbated by the fact that a large part of Congress tends to turn over each

decade, and educating Congress and its staff is constrained by the Hatch Act prohibition on government employees lobbying Congress. It is also inevitable that members of Congress are often more concerned about competing state and local appropriation priorities that influence their reelection. In recent decades, the run up to the 1980, 1990 and 2000 decennial censuses all involved serious budget battles. Conflict has been especially inflamed by poorly informed and contentious disputes over sampling to estimate (measure) errors of “complete” enumeration for adjustment purposes.

Forced by Congress to constrain or reduce costs, the Census Bureau often had to cut back on its other products, including the COA. For example, real funding for the 1982 COA was 29 percent less than that for the 1978 COA.³ At such times, it has even been suggested that the COA be deferred or skipped, much to the anger of agricultural interests. Since the 1970s, COAs have become even more contentious when changes in the definition of a farm have been proposed to cut costs. Scale economies and concentration of farm production since World War II have made periodic changes in the definition a reasonable notion, but a politically untenable one. Consequently, despite efforts to raise the minimum to as high as \$10,000 a year of sales, today’s definition of a farm or ranch is the same as in the 1974 COA: any place from which \$1000 or more of agricultural products were produced and sold or normally would have been sold during the Census year. The same definition of a farm or ranch is used currently for other USDA surveys. Although triggered by a budget problem, this definition is the compromise result of an intense battle in the early 1970s between those who view farming as a business and support higher sales requirements and those who view farming as a way of life and favor lower requirements.

In the build-up to the 1997 COA, all of these issues again erupted. This time the Bureau of the Census faced simultaneous and politically difficult battles over the funding and design of the 2000 Population Census as well as the 1997 Census of Agriculture. Agricultural interests had several times in the past lobbied Congress to transfer the COA to the U.S. Department of Agriculture (USDA). This time Congress obliged—and on August 6, 1996, the President signed the Appropriations Bill enacting the transfer which would take place in early 1997 (PL104-180), well into the implementation stage of the 1997 COA. It was a time that tested everyone’s mettle. Agricultural census personnel had to decide between staying in the Commerce Department or transferring to USDA. More than 90 percent chose USDA. The Commerce Department, Census Bureau,

USDA and its National Agricultural Statistics Service cooperated under great time pressure to execute the design already developed for the 1997 COA. Since then, the COA has become a permanent part of NASS's agricultural statistics program. The Bureau of Census still aids NASS by providing reimbursable services from its specialized, high-volume data collection and processing center in Jeffersonville, Indiana.



CHAPTER 2

Why a Census of Agriculture?

NASS documents suggest that the COA is one of the most referenced sources of data and statistics on the nation's agricultural sector, one that is used daily across America as an essential input to planning and decision-making at the county, state and national levels.

But why would a nation look to a census of its agricultural sector instead of to, say, less expensive sample surveys for the data its citizens need. A reviewer of this report has suggested that the reasons for a Census of Agriculture are as follows:⁴

- to provide a benchmark for annual estimates of crop acreages and livestock inventories on farms;
- to provide a list for inter-census surveys;
- to provide geographic detail for small geographic areas;
- to document acreages and inventories of uncommon crops and animals that may be missed with sample surveys; and
- to provide the capacity for detailed cross-tabulations (such as the number of minority-operated farms producing a specified crop).

Justification for collecting data via a complete enumeration of all farms as opposed to sample surveys should meet at least these criteria. Likewise, these reasons for a census provide the criteria for prioritizing Census questionnaire content.

Legislative Authority and Mandates. Legislative authority for the COA comes from the *Census of Agriculture Act of 1997*.⁵ The Act

- requires that the Secretary of Agriculture conduct a COA in 1998 and every fifth year thereafter to collect data relating to the year immediately preceding the year in which the Census is taken;
- provides for penalties for refusing to respond to the Census or for giving fraudulent answers;
- identifies the area to be covered as all fifty states, the District of Columbia, Puerto Rico, the Northern Mariana Islands, the U.S. Virgin Islands and Guam;
- mandates cooperation between the Secretary of Agriculture and the Secretary of Commerce; and
- requires protection of confidentiality of any data provided by individuals and firms.⁶

Contrary to common belief, the Act does not mandate what data the COA shall collect. Nevertheless, certain data are used by various federal agencies in managing legally mandated programs. Other COA data are needed by the Bureau of Economic Analysis in the Department of Commerce to estimate agricultural components of the congressionally mandated National Income Accounts. And still other data—such as the number of farms and production of major commodities—are simply expected by Congress and other USDA agencies. While NASS does not maintain a comprehensive record of uses of Census data, the data items collected on the COA survey over time suggest a clear list of priorities as perceived by NASS.

Mission and Purpose. The mission of the COA is incorporated in that of NASS: “to provide timely, accurate and useful statistics in service to U.S. agriculture.”

An informal statement of purpose for the COA, provided by NASS staff, reads as follows: “The Census of Agriculture is to be conducted every five years to provide the most complete and comprehensive picture of American agriculture, including the only comprehensive agricultural and demographic profile of America’s farmers and ranchers at the national, state and county levels. The timely release of several million data cells on American agriculture is done one year after the initial mailing of the census questionnaires.”⁷ Part and parcel of that complete and comprehensive picture is the ongoing change within agriculture and the role it plays in U.S. Society and economy.

Finally, other documentation provided by NASS contained the statement that, in the past, “the two main goals of the Census of Agriculture were to count the number of farms and to provide county-level data.” Those traditional goals have been augmented now by usage to include insight into such issues as structural change of the farm sector, environmental phenomena and the well-being of farming-related people.

The legislative authority and formal mission, then, leave NASS with considerable latitude regarding which data are collected and how those data are collected. That flexibility, however, is constrained somewhat by requirements for certain data for legal and administrative purposes; budget and respondent burden restrictions imposed by Congress and the Office of Management and Budget (OMB); and institutionalized uses of specific data by traditional stakeholder organizations. Consequently, there are limits to the data that can be collected. Adding new questions often means dropping old ones.

How then does NASS deal with conflicting demands and decide what data to collect? First, the agency seeks input on COA content through a variety of means and from a wide range of stakeholders. Second, NASS has a set of criteria against which existing data items or requests for new data (i.e., new inquiries on the questionnaire) are measured. These criteria are discussed in Chapter 8 of this report. In that chapter, the review panel offers recommendations for improving the decision process regarding COA content.

Uses and Users of COA Data. According to the 2002 Census of Agriculture, “Agriculture census data are routinely used by farm organizations, businesses, state departments of agriculture, elected representatives and legislative bodies at all levels of government, public and private sector analysts and colleges and universities. Agriculture census data are used to:

- Evaluate, change, promote and formulate farm and rural policies and programs that help agricultural producers;
- Study historical trends, assess current conditions and plan for the future;
- Formulate market strategies, provide more efficient production and distribution systems and locate agriculture-related enterprises;
- Make energy projections for geographic areas and forecast needs for agricultural producers and their communities;
- Allocate local and national funds for farm programs, e.g., agricultural research, soil conservation programs and Land-Grant colleges and universities;
- Plan for geographic-specific operations during drought and emergency outbreaks of diseases or infestations of pests.

In addition, agricultural news media and agricultural associations use Census of Agriculture data to establish the general context for stories and articles on U.S. agriculture and the foods we produce.”^{8,9}



CHAPTER 3

Recent Changes and Improvements

Presentations and materials provided to the review panel by NASS support the contention that all aspects of the COA are open for evaluation of possible improvements. And while NASS had no opportunity to make changes to the 1997 COA, the results were published a year sooner than the Census Bureau did with the 1992 COA—an improvement much appreciated by data users.

Utilizing its limited experience with the 1997 COA, NASS attempted a number of improvements for the 2002 COA. Responding to concerns about under-coverage of small and minority-operated farms, NASS implemented several activities:

- directing NASS field offices in each state to utilize all available sources of information to improve the list frame;
- obtaining mailing lists likely to contain names and addresses of minority farm operators;
- conducting pre-census promotion activities that targeted women, Native American, Native Alaskan, Black, and Spanish, Hispanic and Latino origin farm operators;
- adding a supplemental area-frame sample to improve the coverage evaluation; and
- enumerating multiple operators per farm, which helped reveal the importance of women in agriculture.

The 2002 COA was the first to apply full-coverage adjustment to all data tables, rather than showing the adjustments apart from the tables. Data from the 1997 COA were then re-summarized using the 2002 procedures to make the two censuses comparable. User reaction to this change was reported by NASS to be quite positive.

Prior to the 2002 COA, NASS adopted a totally re-engineered first-generation data processing system. The re-engineering started too late and did not have volume testing prior to full implementation. While the processing system concept was sound, system performance and stability were not good. Nevertheless, NASS delivered the COA products on schedule.

Frustrations from the 2002 experience led NASS officials to start earlier with vision and planning for the 2007 COA. The agency administrator put forth a vision of a successful Census and set high standards, which seem to be fully supported throughout the Agency. NASS then divided the entire COA process into ten component parts or functions, assigned responsibility for each component to a team champion and put into place mechanisms ensuring full cooperation and coordination across the component activities. In addition, NASS invested heavily in evaluating the successes and disappointments in the 2002 COA, analyzing the lessons learned from both and putting improvements in place for the 2007 COA.¹⁰ Therefore, despite difficulties stemming from inheriting the COA in the middle of the 1997 cycle and, in our view, the attempt to do too much too fast for the 2002 COA, NASS has made impressive progress and should be commended for its commitment to enhancing the quality and usefulness of the COA.





CHAPTER 4

Current Issues and Problems

As with any major statistical undertaking, new issues constantly arise in the COA process, and old issues are either addressed or remain as dilemmas. In briefings to the panel, NASS staff provided a methodical listing of issues and questions pertaining to all aspects of the COA. Panel members raised numerous other issues. Following is an abbreviated list of issues that provoked considerable discussion.

What is a farm? The legal definition of a farm (any place from which \$1000 or more of agricultural products were produced and sold or normally would have been sold during the Census year) is set by USDA in consultation with members of Congress. The panel noted, however, that, the growth in large complex agricultural operations, integrated production, non-traditional farms and “lifestyle” farms have made practical interpretation of the definition a continuing challenge. What is the unit of observation for a large complex agricultural operation, producing in multiple geographic locations and whose operators are tied to the operation with multiple business arrangements? For integrated poultry operations, what price should be applied to the chickens grown? If a suburban family on a few acres has a horse and gets \$1000 or more for stud fees, is the place a farm? Suppose the family gets no stud fees, but gets income from charging for horseback rides?

NASS has rules for these and other definitional situations, but the issues of farm definition and the data relevant to that definition continue to challenge the Agency. Moreover, these rules are not fully transparent to users of COA data. For integrated and large complex operations, the issue is one of obtaining accurate and complete aggregate data. For the large numbers of small operations, the definition of a farm affects the number of farms. In the face of such growing diversity, a system for classifying farms becomes critical. (See Recommendations 6.1 and 8.2.)

How much should NASS spend to find small and minority-owned farms? Most larger and commercial farms show up on the NASS list frame. To find small and minority-owned farms, NASS has devoted a significant amount of its resources, expanding its area samples and engaging in a major public relations campaign. Although these efforts by NASS are important to improve our understanding of the contributions that these smaller

units make to agricultural production, the resources they use and the characteristics of their operators, limited budgets suggest the need to continue to explore alternative methods for assuring the representation of these units in the Census and obtaining this information. (See Recommendations 6.3, 6.6, 6.7, 7.1, 7.3, 9.1, 9.2 and 10.3.)

What criteria should be used to prioritize data collected by the COA? For every COA, demands for data exceed what can be supplied within the budgetary, regulatory and respondent-burden constraints placed on the COA. NASS has developed guidelines to address the priority issue, but the issue does not go away. Questions still arise about whether some data collected by the COA overlap or duplicate data collected from other surveys. Could some data be obtained from administrative sources and, thus, free up space on the questionnaire for new data? More effort is needed to fully understand what uses are being made of data currently collected. Could information on those uses be saved and used more systematically to weigh the value of individual data items? Feedback from COA stakeholders suggests they want four broad types of data:

1. Traditional agricultural data (How many farms? What is produced? How much? Where? What are the expenses of production?)
2. Data on the changing structure of agriculture (concentration, size distribution of farms and production, types and degree of integration or coordination with the rest of the marketing chain).
3. Data on practices and land use that address a wide array of environmental concerns.
4. Geographic-specific data on the well-being of people associated with farming.

Not all the demands of stakeholders can be satisfied. Prioritizing what data to collect continues to be a challenge for the COA. (See Recommendations 8.1 and 8.2 and discussion in Chapter 8.)

Should NASS move more aggressively to online reporting? For the 2007 Census, NASS is giving farmers the option of responding online. Developing convenient and confidential online response programs requires resources, but online reporting could make processing more efficient and improve data quality. NASS has already moved closer to state-of-the-art data processing with its print versions of the COA. Careful evaluation of the 2007 experience with online data collection can help in planning the 2012 COA. (See Recommendations 6.2 and 7.4.)



How should incomplete questionnaires and under-coverage be handled? The technical issues of “imputation” to cover data gaps and coverage adjustments are a persistent challenge. Many questionnaires are returned incomplete and a large number of data cells have to be filled or imputed using a variety of statistical techniques. The appropriateness of alternative imputation techniques is a subject of debate among statisticians—inside and outside the Agency. Over time, NASS has moved to more formal and automatic imputation processes to improve consistency of imputations from state to state, but human judgment still plays a role. Similar questions apply to adjusting farm numbers and data to account for under-coverage—that is, farms missed by the survey. (See *Recommendations 9.1, 9.2, 9.3 and 9.5.*)

How much transparency is enough? A recent report from the Government Accountability Office (GAO) suggested that NASS should do more to improve the transparency of information on the accuracy of COA data and on the technical procedures used to deal with imputation and coverage adjustment.¹¹ Some stakeholders have suggested that COA data products be accompanied by estimates of standard error, coefficients of variation and other information that would give the data user a better understanding of the quality and reliability of the data. Such information might be important for a researcher wanting to know the significance of small changes in the data, but not for a user needing only a close approximation of a data item. NASS does internal analyses of data accuracy and has procedural information that could be made available. Doing so could enhance public confidence in Census data. (See *Recommendations 6.4, 6.5 and 9.6.*)

Is the county still the appropriate level for aggregation of data? With fewer and larger farms, more and more data items are suppressed to protect the identity of individual producers. This can result in distortions of county data, as well as state data that may not match sums of county data. This problem will get worse as commercial farms become larger. Furthermore, the number of farms operating in multiple counties is increasing. Some users argue for larger aggregations of data, such as major watersheds and Agricultural Statistics Districts (usually about ten counties in size), while others argue for the flexibility to aggregate data to fit their unique interests and needs. (See *Recommendation 8.2 and related discussion in Chapter 8.*)

How user-friendly should COA data products and services be? Prior to the 2002 COA, data products were “canned” tables and graphics for counties, states

and the U.S. Totals. NASS tries to be responsive to requests for additional and modified tabulations and occasionally makes special tabulations for important policy or administrative uses. But today’s data users are sophisticated and can access technology that allows manipulation and reconfiguration of data to fit the users’ needs and to allow examination of all kinds of relationships among and within datasets. Researchers, in particular, seek the flexibility to package data items to fit their needs. NASS moved to partially accommodate these needs by setting up so-called data labs, usually in NASS field offices, where researchers could come and use the data in a restrictive environment designed to protect confidentiality of individual farm data. Individuals and organizations can also request that NASS itself make special tabulations of COA data for a negotiated fee. But the demand continues to grow for an expansion of data products and services, including databases that can be accessed electronically and reconfigured to meet user needs. The challenge to NASS is how to be more responsive to this demand while ensuring the integrity of the data and protecting confidentiality. (See *Recommendations 10.1 and 10.2.*)

Should farms be geo-referenced? As part of users’ demand that they be able to aggregate data to meet their unique needs (e.g., for watersheds), some have called for recording the spatial location of farms as a point or polygon(s) that can be connected to the COA database. This request raises many issues, such as what site on the farm is to be geo-referenced and how can such information be used without revealing the identity of a farm? The continuing revolution in information technology will generate more demands for user-friendly information based on geo-referenced data. (See *Recommendation 8.2 and related discussion in Chapter 8.*)

Are research resources adequate? When NASS inherited the COA, it did not inherit the research staff that had supported the COA at the Census Bureau. With resources stretched thin, NASS is now challenged to balance the day-to-day operation of the COA and other statistical reports with the need to conduct research on the statistical process. NASS officials stated that resources once devoted to research have been shifted to meet current operations needs, including list building. Eventually such a shift will undermine the ability of NASS to perform its functions effectively and to adjust its operations to capture changes in the population from which and for which it collects information. (See *Recommendations 6.1, 6.3, 6.5, 8.3, 9.1, 9.2, 9.3, 9.4, 9.5 and 10.1.*)



CHAPTER 5

Mega-trends and Future Challenges

Technical expertise is one of NASS's great strengths. Hence, the Agency naturally focuses on "doing things right." And while doing things right is important, so, too, is "doing the right things." Determination of the right things is influenced by the issues stated in the previous section as well as the mega-trends and future challenges described here.

Knowing that its recommendations must address the future not the past, the panel considered changes and trends already evident in agriculture, the food sector, the rural economy, the global economy and society at large, as well as those looming on the horizon. These will affect the COA in many ways and range from collection and dissemination of data to the purposes of the Census itself. Below is a brief list of some of these changes and trends. It is by no means complete, but serves to demonstrate that the world is changing rapidly and that COA planning must be aggressively forward looking. To do otherwise will put the relevance and usefulness of the COA at risk and, perhaps, jeopardize its very survival.

Structural changes in the food system. Huge changes in the structure and organization of the agri-food system have taken place in recent decades and will continue at a rapid pace. Industrialization of the agri-food system and the tightly coordinated stages of the value chain—from input suppliers to producers to final consumers—call for new and different data and new approaches to collecting and disseminating data. Some of the characteristics and continuing consequences of the industrialization process include:

- increasing concentration and competition in all stages of the agri-food system;
- bifurcation of the farming sector into a growing number of small, mostly holdings operated by "lifestyle" operators, producing a small and declining share of all farm output and a growing number of large farms producing most of the commercial agricultural products;
- integration or tight coordination of the stages of the agri-food system that blurs the delineation between production, processing and marketing enterprises;
- decoupling of rural well-being and production agriculture;

- more coordination of production decisions further up the value chain (i.e., by processors and retailers); and
- globalization of sourcing and marketing of agricultural products.

These and associated structural changes have enormous consequences for the COA and, indeed, for all agricultural data systems.

- The presence of more large commercial farms increases potential disclosure problems—especially at the county level, but also at the state level.
- Larger farms have more complex operations, making it more difficult to design a questionnaire that applies to a multi-unit farming enterprise.
- Integration of production and marketing makes it more difficult to establish farm-level commodity prices and, hence, value of farm production.
- While farm income was once a barometer of rural well-being, it now tells policymakers little about how most rural people are faring.
- Small and minority-owned farms produce only a relatively small fraction of U.S. farm output, and, in many cases, the families operating these units do not depend on farming to provide most of their income. Nevertheless, their large numbers, purchase of inputs, amount of land operated and, thus, their impact on the environment and use of public services make it important to collect information about their operations. In many cases, however, they do not identify themselves with traditional farming and ranching and do not see the value in responding to the COA. In addition, they may be hard to identify since they often have little interaction with agricultural institutions.

Advances in information technology. NASS surveys reveal that while over half of all U.S. farmers have access to computers, only about a third of them report using computers for their farm businesses. However, two-thirds of larger commercial producers use them for everything from keeping records to accessing technical and market information online. As a new generation of technology-literate operators takes the place of retiring operators, use of computers and related technologies has become standard operating procedure. This presents the opportunity for NASS to structure the questions on the Census of Agriculture to match commercially available software used by farmers for record-keeping and/or to



provide free electronic farm accounting software systems that match NASS data collection requirements. By adopting the software, the electronic transfer of production and expenditure data from the respondent to NASS would be easier. Likewise advances in geospatial technologies portend possible changes in the COA. For example, these technologies could change production techniques and practices, permit geo-referencing of survey observation units and facilitate unique geographic aggregations of data to fit COA user needs.

Growth in data demands. We live in a society that seeks ever more information about an ever-broader array of subjects. The same is true for agriculture. From legislatures to consumers to regulatory agencies to environmental advocates, the number and diversity of COA data users grow, as does their demand for data. The ability to gather more data, however, is constrained. Existing users are unwilling to give up “their” data to make room for new data in a fixed-length questionnaire.

At the same time, respondents complain about the time required to complete COA questionnaires and the amount of data requested. Furthermore, the Paperwork Reduction Act sets limits on “respondent burden.”

Agriculture as a source of renewable energy. There seems little doubt that agriculture will increasingly be seen as a source of renewable energy in the United States. With that will come changes to the agricultural sector—changes which the COA may be asked to track. For example, new organizational structures and practices may emerge; new commodities may be added to the list (corn for ethanol versus corn for feed, switch grass, etc.); or new farm enterprises may develop, all generating new demands for data and new challenges for collecting it.

Biotechnology revolution. Some observers say the 21st Century will be the “age of biology,” just as some saw the 20th Century as the “age of physics.” The biotech revolution will generate changes in agriculture, the food system and more, greater even than the changes wrought by new technology in the preceding century. It will bring about new farm and food products, new ways of production and new relationships between farmers and other (often new) actors in the industry. At this point, however, we have more questions than answers. For example,

- Will bio-pharmaceutical production on farmland, or in warehouses, be considered farming?
- Will corn or soybeans genetically engineered to make industrial products be considered distinct from corn or soybeans engineered to feed poultry? This, of course, will depend upon the demand for information for private market decision making and for policy decisions.
- If processors specify genetics, production practices, delivery terms and financial rewards, where is the line between the farmer and the processor?
- Where will the new field of nanotechnology, in combination with biotechnology, lead us in terms of new products, new actors in the production and product-design processes and new relationships throughout the production-marketing chain?

Only those questions with implications for the COA have been included.



Federal budget pressures.

Although Congress has maintained funding for the COA, budget deficits and continuing calls to trim federal spending mean that future funding cannot be taken for granted. NASS and COA stakeholders will have to continue demonstrating the value of the COA if it is to survive.

Interest in rural America. The terms “farming” and “rural” are no longer synonymous. Policymakers and the public are increasingly aware that the issues and data

needs of rural America have not been fully addressed. One category of issues deals with the well-being of rural people: persistent pockets of poverty, lack of access to health care, lagging educational attainment, the need for community and economic development and so on. Other issues involve rural space and natural resource use. To understand the policy needs of rural people and communities, we need data. There is pressure on the COA to collect those data. Such pressure heightens the need for NASS, USDA and Congress to better define what the COA is and is not. Without such a broadly accepted definition, NASS will continue to struggle as it tries to respond to pressure for more data about rural America.



Interest in alternative geographic units. For some purposes, the county is no longer a particularly relevant unit of measure. Socio-economic problems extend beyond county lines. People may live in one political jurisdiction, work in another and shop in a third. What we put in the water and in the air has impacts well beyond the point of insertion. For these reasons and others, various geographic combinations (multi-county regions, watersheds, etc.) may be more relevant in the future for certain data collection and data use.

All of these trends are part of an ever-changing agri-food sector and the economy and society in which it operates. NASS must continue to adapt the COA in response to this changing environment and the policy and data demands it generates.





Part II:

Reports and Recommendations of the Panel

CHAPTER 6

General and Cross-cutting Recommendations

In the course of this review several issues came up that are common to two or more of the four topic areas or are of general relevance to the overall review.

Recommendations on those issues are presented here. Specifics of some of these recommendations appear in subsequent chapters.

RECOMMENDATION 6.1

NASS should access a panel of agricultural experts to evaluate implications for the COA of the rapidly changing and restructuring global agri-food system.

The U.S. agri-food system is growing in complexity. So, too, are the firms and organizations involved in it. This growing complexity creates challenges for identifying and surveying farms, determining the relevant unit(s) of observation, determining the relevant data for understanding the sector, distinguishing between production and marketing activities, providing the data and services users want and need and more. While sorting out all the implications and developing recommendations were beyond the scope and capacity of this review, the issue and challenges must not be ignored lest the complexity render much of COA data inaccurate, misleading and irrelevant. NASS should assemble leading agricultural economists, professionals and academics with expertise in this field to examine these structural changes and their implications in depth. This is an issue that can and should be addressed by the American Agricultural Economics Association (AAEA). The current Advisory Committee on Agricultural Statistics can also contribute to this examination; but the effort must be more focused on the issue discussed here (*further discussed in Chapter 8*).

RECOMMENDATION 6.2

Prior to the 2012 COA, NASS should expand the application of information technology consistently throughout the process—from online survey response to data processing and user-friendly data products.

While this recommendation is self explanatory, it cannot be over emphasized. Developing user-friendly online response, state-of-the-art and efficient processing and a new generation of user-friendly data products may be the greatest near-term challenge for NASS and the COA. This challenge, common to other statistical agencies, will be difficult for NASS to handle alone. Therefore, NASS should partner with other agencies such as the Census Bureau and the National Agricultural Library to muster and finance the technical expertise needed. Furthermore, and as a more general policy, NASS should seek to partner with others to address a growing number of challenges faced in common.

RECOMMENDATION 6.3

NASS should invest in additional research capacity to help redesign survey instruments and products, adopt new methods for statistical analysis, manage the potential of new information technology and increase transparency of data characteristics.

Many of the recommendations in this report call for or imply the need for additional research and development to think through the implications before a change is implemented. When the COA moved from the Census Bureau to USDA, most of the research resources stayed behind. The current COA research staff, while highly qualified, is small and must service all NASS statistical programs. Adding resources required to address the research needs identified by this review must be a high priority. Until such resources are secured as permanent staff, NASS may need to bring in temporary assistance—consultants, experts on sabbatical and other short-term arrangements, such as the fellowship program sponsored by the Bureau of Labor Statistics (*further discussed in Chapter 9*).

RECOMMENDATION 6.4

NASS should expand its commitment to transparency in all aspects of the COA and make that transparency replicable and user-friendly.

The need for transparency cuts across all steps of the COA process. Data users need information on data quality, error rates, imputations and other characteristics of the data to assess its usefulness, appropriateness and



interpretation. This is especially true for researchers using the data, but also for policymakers and others who rely upon it. Information about accuracy, imputations, coverage adjustments and other characteristics of the data should be presented in data products themselves and should be easy to interpret (*further discussed in Chapters 9 and 10*).

RECOMMENDATION 6.5

NASS should make its research more available to the statistical community for timely peer review and comments. NASS should also consider forming an external statistical/technical consultation panel.

While NASS has very competent researchers doing excellent research, some of the results of that research fall into the category of “fugitive literature,” often hard for outsiders to find and evaluate. Some of the research reveals information about the COA that would be useful for others to know; i.e., it would assist in addressing transparency objectives. Publishing the research in peer-reviewed journals and presenting research papers at professional meetings would add discipline and rigor to the research and would enhance the professional reputation of NASS and its staff. In the process, NASS would increase its exposure to leading-edge statistical thinking and enhance the professional exposure of its staff. By forming an external panel, NASS would increase access to needed statistical expertise. While NASS has long been active in the statistical profession and has provided some of its most distinguished members, these steps will improve NASS’s capabilities and status.

RECOMMENDATION 6.6

NASS should balance all its COA activities to assure the most effective and efficient use of resources. This includes weighing the marginal costs of adding farms to the list frame versus improving other aspects of the COA. It also includes the possibility of shifting from the questionnaire to sample surveys those data items that do not need to be fully enumerated for all farms and ranches.

The review highlighted several situations where trade-offs are needed to assure the most effective use of

limited resources. For example, coverage is very important, and NASS should pursue all cost-effective means to reduce the number of farms missed by the COA and for which coverage adjustments must be made. Several recommendations in this report address that. However, marginal costs for finding additional missing farms are already high; and those costs must be weighed against the benefits of using those resources elsewhere. Likewise, demand is high for limited space on the questionnaires. But not all data need to be collected and reported at the county level. For example, data on marketing practices, environmental practices, land use, land rental arrangements and landlord information could be collected more cost effectively with sample surveys and reported at levels needed by users. The advantage of the Census of Agriculture and the ARMS program being managed within one agency means that users can obtain data at the required geographic level thanks to the capacity of USDA to use the COA for variables at the county level and to use the ARMS program for variables

at the regional or national level.

Coordination of data sources needs to be driven at a high level within the USDA management structure. In the logical extreme, all COA expenditures should be examined to determine where the marginal dollars buy the greatest payoff, as measured by quantity or quality of data and services for users. The intent of this recommendation is to intensify current efforts by NASS toward greater efficiency in resource use.

RECOMMENDATION 6.7

NASS should incorporate product design into the overall COA planning process, including incorporating more value-added data products into the process for finding farms and generating higher response rates.

The components of the COA process should be considered integral parts of a total system that begins with the desired products and works backwards. A well-defined package of data products can improve efficiency in data processing. Likewise, data products can be designed to improve participation in the Census. This recommendation implies a stronger role for product designers in the overall COA planning process.

Many potential COA respondents are not well connected to the mainstream agricultural community. Many in the



mainstream agricultural community (including Cooperative Extension personnel) are connected, but know little about the COA or are not trained to explain it. NASS should make more effective use of data products to educate people on the COA, train agricultural leaders and educators, demonstrate its value to non-traditional users and generate support for improved participation and data quality. Such a process should link data being collected to statistics that will be provided. A plan that utilizes new data products to expand the awareness of the COA and its value to a wide range of groups should include:

- designing output products that demonstrate the value of the COA to small farms;
- tailoring product demonstrations to specific, targeted farm groups, such as minorities, women, “lifestyle” farmers and others; and
- developing unique data products and training modules to train Extension educators and others who can help reach targeted audiences.

In short, NASS should develop an ongoing program of analytic products that demonstrate the utility of COA data and use these results to advertise the Census program.





CHAPTER 7

Target Population and Response

Overview

The COA defines a farm—and thus its target population—as any “place” from which \$1000 or more of agricultural products were produced and sold or normally would have been sold during the Census year. This definition has been applied since 1974, and strong political reasons argue against changing it. The definition does, however, create significant challenges for NASS in finding its target population and getting it to respond and respond accurately to the COA. Indeed, those challenges are far greater than many outside of agriculture realize. For example, while larger farms are easier for NASS to find, smaller farms are not. Many such “farms” are operated by persons who do not consider themselves farmers and who have little contact with agencies and organizations from whom NASS obtains information to build lists. This is especially true for very small farms, farms operated by minorities and women and farms operated by so-called “lifestyle” operators. Likewise, many such farms—if they do receive the COA questionnaire—do not respond because they think it does not apply to them.

Consequently, the list coverage was 79 percent for all farms, but those not on the Census Mailing List (CML) were mostly small and minority-operated farms. The list coverage for farm sales and land in farms was 96 percent. However, the list coverage for Black-operated farms, for example, was only 52 percent. For 2002, NASS used an area frame sample to adjust for list under-coverage, bringing coverage after adjustment to nearly 100 percent. While NASS is making a major effort to improve Census Mailing List coverage for 2007, especially for small and minority-operated farms, the marginal costs for doing so are quite high. This chapter looks at cost-effective ways to improve list coverage and overall participation in the Census.

Note: The review panel does not wish to imply that increasing the sample size or number of under-represented respondents is a goal in and of itself. Rather, differential response is a red flag, suggesting non-representativeness. Increasing representativeness is the goal, and achieving that goal is questionable if there is a large differential in the undercount.

Improving coverage through more effective collaboration with other agencies

Background. Information used to build the list of farms for COA participation comes from many sources: USDA, producer and agricultural organizations, local governments, the Internal Revenue Service, community organizations and so on. Because COA lists are assembled at the state level, the sources vary. It is important to tap all potential collaborators to reach out and encourage COA participation among their respective networks, not just those currently used.

One potentially valuable source of information was missing in the information presented to the review panel: USDA agencies that have county office networks and are charged with reaching USDA’s underserved clientele—specifically minorities, women, the disabled, limited resource farmers and small-scale farmers. These agencies include:

- The Cooperative Extension Service (CES) is a decentralized organization with offices in nearly every county. The state and local units are part of the state Land Grant universities and are responsive to local needs and constituents. Because of their influence and relationships with local agricultural producers, CES county personnel could help identify farmers to include in the COA as well as encourage farmers to complete and return census forms. In addition, CES programs at 1890 and 1994 Land Grant institutions can be enlisted in NASS efforts to improve coverage of small and minority farmers. Finally, 4-H—the youth division of CES—could be used to create awareness and advocacy for COA participation.
- Each state office of the Natural Resource Conservation Service (NRCS) has a Small Farm Coordinator who reaches out to small and minority operators with NRCS programs. These coordinators could also motivate and facilitate participation in the COA. While NRCS does not have an office in every county, its District Conservationists have strong ties to commercial agriculture, and the agency also collaborates with the network of state-funded State Soil and Water Conservation Districts.
- The Farm Service Agency (FSA) administers and manages farm commodity, credit, conservation, disaster and loan programs through a network of federal, state and county offices. These offices certify

farmers for farm programs and pay out farm subsidies and disaster payments. More than 8,000 farmer county-committee members serve in FSA county offices nationwide. As such, FSA is a prime candidate for supporting and facilitating participation in the COA.

In short, many organizations have contacts with firms and persons who may be engaged in farming. These organizations could be made more aware of the COA and its importance to their contacts and could be used more effectively to improve COA coverage.

RECOMMENDATION 7.1

NASS should continue partnering with other organizations to increase COA coverage, especially of farm types that currently have low coverage levels.

Strategies for implementing this recommendation:

- Increase cooperation with the State Cooperative Extension Service and Associate Director for Agriculture and Natural Resources (or equivalent) who oversees state programs in this subject matter.
- In each state, brief Extension educators and encourage Extension agents to discuss participation in the COA with farmers and show them how participation benefits farmers.
- Reach out to the full range of organizations viewed as credible by farmers and encourage them to support COA participation among their respective networks. Examples of such organizations include State Commissioners of Agriculture, FFA, rural development groups, minority farmer groups, minority development groups, faith-based groups, environmental organizations, educational associations and so on.



Improving the Agricultural Identification Survey

Background. In 2002, NASS initiated a one-page, seven-question survey to screen potential farms (identified by sources described previously) before placing them on the Census Mailing List (CML)—the list of farms that receive the COA questionnaire. One follow-up mailing was sent

to non-respondents. NASS later sent the survey to additional potential farms, but sent no follow-up. Based on these two screener surveys, 349,664 farms were added to the CML. In 2007, this screener questionnaire was modified and renamed the Agricultural Identification Survey (AIS). In 2007, it is now a four-page, seventeen-question survey. While NASS based its decision to use the longer AIS questionnaire on an evaluation of experience with the 2002 AIS, the longer instrument might discourage potential respondents.

RECOMMENDATION 7.2

NASS should continue testing the Agricultural Identification Survey to assure adequate information to identify farms for the list frame, while not discouraging increased cooperation and participation in the COA.

Strategies for implementing this recommendation:

- Review experience with the 2007 AIS form to determine respondent burden and willingness to report.
- Include a follow-up mailing strategy to improve response rates.
- Provide an accompanying letter that reinforces the overall theme and communication strategy of the COA. The same motivations that drive participation (completion and return) of the survey also shape the desire to be listed to receive the census form itself.
- Make the AIS form available online to facilitate inclusion and modification of list-frame information.

Using public relations strategies to improve participation rates

Background. NASS faces obstacles in both building the COA list and getting farmers on that list to respond. Yet many of those obstacles can be overcome with appropriately designed and implemented public relations strategies. Such strategies would increase awareness of the COA and the importance of participation. They would provide information that helps farmers respond. And they would assure farmers of the confidentiality of the responses. Furthermore, models are available to build upon.

For the 2000 population census, the Census Bureau mounted a national outreach campaign among Hispanic communities, *Hagase Contar! Make Yourself Count!* It consisted of community outreach activities, census promotion in the media and educational programs. Specifically, the campaign reached out to parents through schools and churches and young adults through community organizations, youth centers, sporting events and concerts. It assisted non-English-speaking immigrants in completing census questionnaires. The media portion of the campaign included national and local public service advertisements for English and Spanish television and radio, articles and opinion pieces in Spanish-language newspapers, Census 2000 newspaper supplements and prime-time census specials on Spanish-language television.

As such, the outreach campaign implemented many of the recommendations identified in ethnographic studies of census participation.

- Involve local media. Local newspapers, radio and television stations are major information sources in ethnic communities because they are in the language of the target population and therefore accessible to large numbers. According to some reports, net undercounts were less than one percent in sample areas where local media were used to promote the census.¹²
- Use local community leaders. Individuals who are widely known and respected in the local community can act as trustworthy promoters of the census. For example, a well-known singer, community worker and TV anchor—all from the community—promoted the 1990 census to a Haitian community in Florida.¹³

In another example, the Federation of Southern Cooperatives, an organization that serves predominantly minority farmers in the South, developed a flier to advertise the COA. This mechanism could be very effective in improving participation in the COA if the flier is friendly and positive and comes from an organization that is known and trusted.

NASS could use similar public relations strategies in areas where significant numbers of minority-operated farms exist. The strategies should be based on assessment of the omission of minorities and immigrants in the COA and the causes behind this problem.

RECOMMENDATION 7.3

NASS should develop and utilize public relations strategies to improve participation rates. (See Recommendation 10.3.)

Strategies for implementing this recommendation:

- Develop and test announcement fliers about the COA that are more “participant friendly.” Include website addresses and phone numbers for more information.
- Have NASS State Directors personally contact leaders of organizations that serve small and minority-operated farms and ask them to encourage COA participation.
- Work with the farm press and public media to endorse and encourage support for COA participation.
- Review mailing procedures and adopt best practices for mail surveys.¹⁴
 - Use four-contact procedure: pre-notice, first mailing of questionnaire, postcard reminder and second mailing of questionnaire.
 - Avoid Christmas-time mailings, which compete with a high volume of mail.
 - Consider eliminating the deadline on the Census form. Deadlines often encourage recipients to put the form aside until the deadline is closer. In the meantime, the questionnaire is often misplaced and not returned. Research shows that simply asking respondents to return the questionnaire as soon as possible works.

Making more effective use of advanced information technology

Background: Response Rates and Data Quality.

Although the 79 percent national response rate for the 2002 COA was in line with U.S. government response rate survey standards, the rate can be improved. As part of its attempt to improve response rates, NASS plans to introduce electronic response as an option for the 2007 COA for those with access to the Internet. With 58 percent of U.S. households online in 2006, the option makes good sense. Indeed, it has several benefits.

- Because respondents complete the form, there should be a lower rate of transcription error compared to data entry for mail surveys.



- Recording the data electronically allows for continuous check on unacceptable answers, insisting on acceptable ones. For example, if a series of numerical answers is supposed to total to 100 percent, electronic data entry can check the arithmetic automatically.
- Unlike paper surveys, online versions can include hyperlinks within the questionnaire pointing to detailed descriptions, clarifications and instructions.
- Online surveys with their skip patterns allow many different modules of questions to be implemented. Online surveys can also take advantage of the power of visual design elements far more than paper surveys; the graphic nature of the web makes the addition of graphics, color and sound quite inexpensive. Among other things, this opens up a wide array of response options: radio boxes, check boxes, Likert scales, drop-down menus and skip patterns, as well as the inclusion of graphics, color and sound. All of these can affect the response rate, the dropout rate and even the responses themselves. For example, in a study comparing scrollable web surveys and interactive web surveys (a design that displays one question at a time on screen), researchers found that if they altered the presentation of the single-item screen to allow multiple items to appear on the screen, completion time for the survey was faster, there were fewer unanswered questions and there was more similarity in answers than when questions were presented individually.¹⁵



Online surveys, however, are not without problems.¹⁶

- Questionnaires may not look the same in different browsers and on different monitors. Therefore, respondents may see different views of the same question and not receive the same visual stimulus.
- Respondents may have different levels of computer expertise. This lack of computer expertise can be a source of error or non-response.
- Concerns exist about data security on the server.
- Respondents may have privacy concerns.

In addition, there are reasons why people do not complete online surveys: open-ended questions, questions arranged in tables, fancy or graphically complex design, pull-down menus, unclear instructions and the absence of navigation aids.¹⁷ Consequently, survey forms should be sent by mail and made available to complete on a website.

Whether the electronic option will improve response rates and quality of the data provided depends on several factors: the specific survey, survey and question design, specific audience, method used to notify people of the survey and type of information requested. Researchers have also experimented with fonts and background colors that make the survey instrument easy to read. The goal is to have respondents focus on the content of the survey, not some small graphics and odd-looking fonts that may be distracting. One study demonstrated that plain online surveys gave a better response rate than those with a fancy design containing colors, graphics and tables. Several factors explain. Longer questionnaires

have lower response rates because there seems to be a time limit that people are willing to spend completing surveys. Online surveys with a fancy design take longer to download on slower Internet connections, increasing time to complete the survey. In addition, not all features of fancy questionnaires may appear on old browsers or hardware.¹⁸ Thus, careful consideration needs to be used in testing online questionnaires on a variety of browsers and connection speeds.

Finally, pre-notification of the intent of the survey, the number of contacts, personalized contacts, simpler formats and plain design all have been shown to improve response rates for online surveys.¹⁹

Background: Help Line and Frequently Asked Questions. Web-based surveys have the potential to be an efficient tool for collecting large quantities of data. Along with their benefits, however, they present challenges. Respondents need the wherewithal to overcome technical difficulties related to the use of computers and associated software. Web-based surveys also impose different cognitive burdens on the respondent who may misunderstand or misinterpret questionnaire items. For this reason, research organizations have begun to provide assistance in the

form of toll-free telephone numbers for reaching a help desk where trained professionals are able to provide guidance.²⁰

The survey literature suggests two simple guidelines for developing online surveys, which would enhance the quality of data collected. First, make certain that respondents know how to use the technology. Second, make sure that computer-generated questionnaire design and format on the screen are very similar to a self-administered census questionnaire. In addition, a help desk and a list of Frequently Asked Questions (FAQ) would complement the first guideline and improve overall data quality.

A study comparing survey results using a self-administered version of the instrument and completing the interview via Computer Assisted Telephone Interview (CATI) found two key benefits of a help desk.²¹ First, a higher rate of response was obtained as help-desk personnel were able to complete interviews with respondents who may otherwise have been excluded if problems were not resolved. Second, respondents were able to complete the interview faster.

Finally, information collected on problems encountered by help-desk personnel can be used to train and prepare help-desk personnel. The experience gained by NASS in allowing online response to the 2007 questionnaire could be the basis of an assessment of the potential value of online reporting for the 2012 COA.

RECOMMENDATION 7.4

NASS should take stronger steps to promote the use of the web as a mode of response.

Strategies for implementing this recommendation:

- Aggressively promote expansion of online reporting and invest heavily in design of the online questionnaire to enhance response rates, completion rates and quality of data.
- Where appropriate or needed, use hyperlinks in the online questionnaire to provide additional information on what exactly is being asked in the question.
- Provide access to assistance—either help-line phone number or chat room—on each screen of the questionnaire.
- Provide a FAQ section.
- Begin requesting email addresses for households to facilitate advance communication and Census follow-up.

- Mount a major effort to expand the NASS/COA website and facilitate web access to Census results and data products. Doing so will show respondents the value of the output, thus increasing motivation for responding.
- Assess the online mode versus traditional mode for 2007 COA to provide basis for web development for 2012. Develop appropriate testing procedures.
- To compensate for various modem speeds and browsers, investigate the ability to download a PDF version of the questionnaire and return the completed form electronically.

As one final point, the panel discussed using incentive programs to increase participation in the COA. Financial and other incentives have often been used to increase participation in surveys, and research shows that incentive programs can be cost-effective. Incentives have never been used with the COA, in part because response is legally mandated.





CHAPTER 8

Census Content Development

Overview

As discussed in Part I of this report, the act transferring the Census of Agriculture to USDA provides little guidance with regard to its scope or the data to be collected—that is, the content of the COA. Certain data have come to be expected to be available for meeting a variety of policy and program needs. Federal, state and local officials and private citizens have come to expect that the Census will provide a broad snapshot of American agriculture and its geographic characteristics. NASS uses the Census, along with data from its total program of surveys, to satisfy these data demands and expectations. They have done it well.

Nevertheless, an evolving agricultural sector necessitates ongoing evaluation and revision in Census content. For several decades, the Census of Agriculture was the primary source of data on U.S. agriculture. Now, it is but one of many data sources. Agriculture has become more complex. Demands for data continue to outstrip resources and limits on respondent burden.

In the context of these changes and pressures, the review panel examined:

- criteria for Census content development;
- content development, testing and management;
- the target population and implications for content;
- some specific content issues;
- creating linkages to other federal data sets; and
- capitalizing on other agricultural data and surveys.

Criteria for Census content development

NASS has evolved a set of criteria against which existing data or requests for new data are measured:

- data directly mandated by the Congress;
- data requested or required by other federal agencies to meet their legislative mandates;
- data needed by federal agencies to evaluate existing federal programs;
- data that if omitted would result in additional respondent burden and cost for a new survey for other agencies or users;

- data required for classification of farms into groups historically depicted;
- data needed to improve coverage of the COA;
- data on current problems; and
- data that a majority of respondents are able to provide.²²

The roots of these criteria trace back to practical issues with which NASS must deal. For example, there is always pressure from public and private sources to collect data on “hot” issues, such as the current strong interests in energy and immigrant labor. The need by other federal agencies for data to manage their programs and meet their mandates is legitimate. There appear to be no direct mandates from the Congress for any specific data, although members of Congress have certainly come to expect certain national, state and district data to be available. The Paperwork Reduction Act required the Office of Management and Budget (OMB) to approve only “necessary” questions on the Census. But how is “necessary” determined, and how is it determined that necessary data be collected by the Census rather than in some other survey?

While all the criteria currently used by NASS have merit and have been used historically to prioritize Census content, there is nothing inherent in them that require the data to be collected by the COA, as opposed to other surveys. The panel feels that NASS needs a more rigorous set of criteria, focused on two questions:

1. Why are the data needed?
2. Why should the data in question be collected by the Census?

The first question relates to the OMB mandate to show that any specific data item is “necessary.” This is not an easy mandate to follow, primarily because NASS has no good way to account for all the uses of a specific data item and the value of improvements in decisions made because that data item is available. However, for requests for new data, whether collected via the Census or otherwise, it is reasonable for NASS to ask those who request the data to provide evidence of 1) who will use the data, 2) what decisions will be made with the data and 3) what value can be attached to the data because of the availability of the data. This is evidence that NASS can then take to OMB. Data items historically collected by the Census could be subjected to the same questions. But again, demonstrating that a data item is necessary does not demonstrate that it should be collected by the Census.



Once a data item is deemed to have sufficient value to meet, in the judgment of NASS and OMB, the “necessary” standard, what criteria should determine that the data should be collected by the Census of Agriculture? The panel members agree that some of the reasons for conducting a census, suggested in Chapter 2, also constitute a set of criteria for determining whether specific data items are appropriate content for the COA.

- Are the data needed to provide a benchmark for NASS’s annual estimates of crop acreages and livestock inventories on farms?
- Are the data needed to provide geographic detail at the county or state level?
- Are the data needed to document uncommon crops, animals or other occurrences not likely to be picked up on sample surveys?
- Are the data needed to provide the capacity for cross-tabulations, especially cross-tabulations with geographic detail?

With these criteria in mind, the statement cited earlier from a NASS document that “The purpose of the Census is to count the number of farms and provide county level data” is not far off base. For most questions being considered for the Census questionnaire, the two most relevant questions are:

1. Is the data item needed for all farms (complete enumeration) in order to have the needed geographic detail?
2. Are the data needed so they can be cross-tabulated with other data?

If the data are important, but they do not meet these criteria, the case is strengthened for viewing the COA as an integral part of a “package” that includes related sample surveys. For the longer run, this may imply integrating the Census more tightly into the total NASS statistical program, with all NASS surveys being treated as optional vehicles for collecting “necessary” data. Each vehicle would have its own appropriate criteria.

All suggestions for content should be tested against the criteria suggested here. Any data not meeting these criteria could likely be collected via sample surveys, even data needed by agencies to meet their legislative mandates.

Improving questionnaire development and testing

Background. COA content is designed to meet many uses: developing the geographic dimensions of market strategies for agribusinesses, evaluating geographic dimensions of agricultural programs and policies, forecasting future agricultural needs, improving methods to increase geographic-nuanced production capacity and for spatial planning for agricultural emergencies. Additionally, COA data are a rich source of local area information, making the data useful to Congress, state and local governments, universities and agribusinesses of all sizes.

To determine COA content, NASS solicits input from an extensive array of external sources. For the 2007 COA, NASS obtained input from the following sources:

- *Federal Register* notices;
- NASS state agricultural statistical offices;
- NASS Advisory Committee on Agricultural Statistics;
- Land Grant universities;
- federal data users;
- data users working group meetings;
- a USDA-wide national data user outreach meeting;
- a list of typical COA users maintained by NASS’s Marketing and Information Services Office;
- a website feedback form; and
- a NASS-specific regional data user meeting.



While a variety of techniques are rightly used to solicit public input on content development (emails, link on website, discussion in user groups), more active solicitation is needed. Emails to 600–700 people and organizations are useful, but not sufficient. Email contacts may not be forwarded to the most appropriate or most interested parties. Personal contacts, including soliciting input from knowledgeable staff in state offices and holding data user meetings where direct input can be sought from stakeholders and researchers known to have an active interest are essential.

NASS recognizes and appreciates the interests of federal partners and stakeholders in the development of COA

content. The review panel commends NASS for its efforts to open its content development to a wide spectrum of stakeholders, having direct contact with data users during the content planning phase and developing a set of content evaluation criteria. However, to accomplish their content determination goals, NASS must publicize the process it will use to make content decisions, utilize more rigorous content evaluation criteria (see *previous section*), notify stakeholders of their content determinations and document their decisions. In addition, NASS should put together a group of staff and external advisers to think about the future, identify what NASS needs to know about the universe, anticipate changes and note how data will be captured.

Testing. NASS conducts tests prior to each COA to evaluate a number of factors affecting the COA program. In the past, these tests evaluated factors affecting response and data quality—format and design of the instrument, new content items, changes to question wording, respondent burden, attitudes affecting response, selected procedural changes and changes in respondent reporting that may lead to misclassification of a farm. Results of these tests were analyzed to identify modifications to incorporate into the final design of the next COA.

No test was conducted for the 1997 COA due to budget cuts and minimal changes to the questionnaire. Major changes were made to all aspects of the 2002 COA, which required testing. The 2007 COA utilized three main testing phases: cognitive pre-testing, national mail-out and follow-up interviews. Analyzing the incidence of data imputation by question with the goal of improving the quality of the questionnaires for future COAs would be beneficial. A large number of imputations for a question suggests that wording may need to be improved or the question eliminated. (See *discussion on Item-Level Imputations in Chapter 9*.)

NASS has made major improvements in content planning and in execution of the content tests conducted for the past several COAs. There is room for further improvement to assure the tests are as efficient as possible and are documented to provide stakeholders an understanding of the decisions made based on the test results. The review panel believes NASS's process for evaluating questionnaire content can be further improved by research that addresses such questions as:

- What decisions are improved by the proposed data?
- What is the value of those improvements?
- Are there more cost-effective sources of the data in question?

RECOMMENDATION 8.1

NASS should develop a comprehensive and transparent system for evaluating the content of the COA questionnaire, including adopting criteria that recognize the unique values of a complete enumeration of all farms, as compared to sample surveys.

Strategies for implementing this recommendation:

- Prior to the 2012 COA, thoroughly “scrub” the content of the questionnaire by examining each question and documenting 1) the need for the data, 2) the known uses of the data, 3) the legally-mandated requirement, if any, for the use, 4) the lowest required geographic level, 5) the variables essential for cross-tabulation and 6) the frequency with which the data are needed. Subsequent enumerations will require acknowledging that these original tenants are still valid. This justification process will establish a benchmark to ensure the utility and relevance of the information collected and that the public burden is minimized to the extent possible. The review of data needs, together with a more clearly defined population (see *section on Targeting, this chapter*) should help focus the scope of the COA.
- Develop an explicit, transparent process on content determination for the COA. This content policy should be used as the basic guideline for all new question proposals from federal agencies, Congress and data users. The policy should be signed by the NASS Administrator and include a purpose and scope, any legal authorities governing content, background and a policy statement that includes the criteria that NASS will use to evaluate proposed new content.
- Publicize this content policy in the Federal Register, and send copies to all stakeholders who have an interest in the content development process.
- Notify all individuals/groups who suggest changes to the 2012 COA content of the outcome and rationale for the decision made regarding their suggestion.
- Thoroughly document the content determination process and release it in print form and on the NASS website.
- Develop a systematic capture of information on data users and uses.

- Log requests for information that is not available; ask other agencies (ERS, NRCS, etc.) to do likewise. Classify the requests according to the appropriate collection vehicle: COA, follow-on surveys or ARMS.
- Maintain an active process for soliciting new and modified content for the COA to include personal contacts beyond mass email solicitations for public input.
- Develop a testing policy that is part of the risk management strategy to ensure that each new or modified question or procedure has been fully tested for:
 - relevance to the public or business decision(s) to be informed with this information;
 - cognitive understandability by the respondent;
 - ability of the respondent to provide the response to a cognitively-understood question; and
 - likelihood that the modification will improve the collection of quality data without reducing overall response rates.
- In determining the scope of the test, design experiments based on hypotheses derived from prior censuses.
- Fully document the results of the tests and make them easily accessible on the NASS website.



Clarifying the target population and its relationship to COA content

Background. The current unit of observation for the COA is any place that meets the official definition of a farm. That begs several questions. Is that “place” a “farm” or a “firm?” Does it make any difference? If so, perhaps the “establishment” as defined and classified by the North American Industry Classification System (NAICS) should be used. What of the notion, still held by many, that the unit of observation is actually the “farm operator household?” There is a demand for data on the household of persons associated with the farm establishment. The larger question, however, is whether the current unit of observation provides sufficient clarity to focus the COA questionnaire, whether it yields high-

priority data and whether it fits the emerging and complex reality of American agriculture?

As commercial agriculture becomes ever more industrialized, the activities and characteristics associated with operator households become less meaningful to understanding the economics of the sector itself. However, household activities and characteristics do help us understand the economics of the approximately 60 percent of farms with annual sales under \$10,000. This predicament arises from the dual nature of U.S. agriculture today, with its large and growing number of small and “lifestyle” farms and the smaller but growing number of large, often complex, operations that produce most of the agricultural product.

In surveys of other economic sectors, the unit of observation is generally the firm. A farm could, of course, be a firm and be associated with a single operator and family. But, conceivably, an agricultural firm could own and operate independently managed farms in multiple states.

Knowing there is a firm that links these multiple farms would be important to understanding the sector’s economic structure. The fact that such cases exist, and are becoming more common, argues for the COA unit of observation to be firms engaged in agricultural production. But a firm might also be engaged in various non-farming activities that may or may not be of relevance to understanding the agricultural sector.

Farms, firms that farm, operator households and rural households are all legitimate units of

observation, as evidenced by the stated interests of COA data users and policymakers. The review panel discussed narrowing the COA focus to firms that acquire inputs and use biological processes to produce plants, plant products, animals and animal products for sale in commercial markets. For these firms, data collection would focus on inputs used, outputs produced, costs, information about processes and practices used in the transformation of inputs into outputs and other information pertinent to the business of the farm firm. Non-farm activities of the farm firm, and of members of the households involved in the firm, would be omitted from the COA survey, as would data on economic and social characteristics of operator households. The intent would be to focus the COA on the “business” of farming.

The advantage of narrowly focusing the COA on the farm business, as just described, is that it provides a clear guide for what should be included and excluded on the COA questionnaire. The difficulty is that, for perhaps half or more of America's approximately two million farms, farming is not strictly a business, and the non-farm activities and characteristics of operator households are intrinsically linked to the operation of the farm. In other words, one cannot understand the economics of the farm business without understanding something about the households that run them. While this may not be the case for large, complex farming businesses, it remains the case for some entities as long as the legal target of the COA is "all places defined as farms." But the trend is toward larger and more complex business entities producing most of the commercial agricultural product. Thus, NASS and COA will be confronted increasingly with the fact that operator household information and information about non-farm activities associated with the farm, while useful to understanding small farms, make little sense for large, complex firms engaged in agriculture. Different surveys for different populations should be considered—particularly as online surveys are increasingly adopted and can easily accommodate alternative forms.

One observer noted that Statistics Canada has a special office or staff that specifically tracks multiple unit farms. Perhaps such a unit should be considered in NASS as part of an effort to better understand large, complex agricultural production operations.

After weighing the conflicting concerns, the review panel was not prepared to recommend any radical changes in the defined target population or unit of observation for the 2012 COA. However, the issue will become more urgent with the continued industrialization of commercial agriculture. For that reason, NASS should begin studying the issue and seeking the best thinking of the relevant professions to determine the most meaningful units of observation for the nation's dynamic and dualistic agricultural sector. (See *Recommendation 6.1.*)

Some specific content issues

Background. Once the list of eligible farms is determined, it is necessary to decide what information should be collected via the Census questionnaire. At this point, it is important to recognize that the Census of Agriculture is only one of many sources of data on agriculture. In addition to asking whether the data are needed, who needs them and for what purposes (i.e., what is the value of their use?), it is important to ask why

the COA survey should be the vehicle for collecting the data. Since NASS conducts the ARMS survey, Census follow-on sample surveys and numerous other sample surveys, in addition to the COA, it appears logical that NASS could and should evaluate requests for data in terms of which survey vehicle would be the most cost-effective and least burdensome on respondents. The COA focuses on the cost and quantity of inputs used, the quantity of agricultural outputs sold and the revenue derived from such sales. Three additional areas of data have historically been gathered and continue to be of great interest to stakeholders because of their importance for policy decisions: agricultural practices, government payments and farm labor. As geo-referencing was frequently mentioned by stakeholders as a future interest, it is also addressed here. Ultimately, all the interests in these expanded data areas must be evaluated against the criteria suggested earlier in this chapter, especially those regarding need for geographic detail and the need to be able to do detailed cross-tabulation.

Agricultural practices. NASS plans to ask farm operators thirteen questions about their technology or practices on the 2007 COA questionnaire. The questions range from Internet access to water usage to the age of barns, with no unifying theme. However, the COA does not ask about a wide range of practices that have great significance to policymakers and other stakeholders. For example, more detail on conservation practices would be useful as would information about specialized marketing arrangements or marketing contracts. While land rental is addressed, leasing of machinery/equipment and livestock is not.

As it is important to understand how technology and farm production practices evolve over time, it is wise to continue to ask questions about new developments in production behavior. The larger question, however, is how best to get answers to these questions. It seems unnecessary to do a complete enumeration to get information on farm practices. ARMS and other sample surveys could provide the same information with a high degree of accuracy.

Government payments. Government payments are a significant source of revenue for many farm firms. They range from land conservation payments to price deficiency payments to disaster relief payments. Each payment is designed to satisfy a social, economic or humanitarian objective defined by Congress. Collectively, they provide a large fraction of net farm income and are an integral part of managing inputs and producing and selling agricultural products. The COA asks respondents

to report “Federal and State Agricultural Payments.” These payments are lumped into four broad categories: 1) direct payments; 2) counter-cyclical payments; 3) other federal agricultural program payments and 4) state and local government agricultural program payments. One weakness of this breakdown is that there is no separate breakout of conservation program payments. They are included in “other federal agricultural program payments.” Since conservation payments are made for the purpose of achieving societal environmental goals and not for the purpose of supporting agricultural production, they probably should be reported separately on the COA questionnaire. It is also important to break out land-retirement programs. It is important to be able to cross-tabulate government payment data with other farm variables.

Because there is widespread belief that COA reports of government payments are not accurate, more precise and detailed information about program payments would be useful. Much information about government payments to farm firms and individuals for agricultural activities is available from USDA. It is possible that the information about government program payments, now generated within USDA, could be integrated with COA data. This would require the adoption of a uniform farm identification system to link together all the data collected by USDA for a particular farm. (See *Linkages section, this chapter.*)

Farm labor. Labor is a major input in agricultural production. Historically, most of it was provided by family members. Viewed from this perspective, the questions on the 2007 COA seem adequate. They capture the number of farm workers and their aggregate cost, a level of detail similar to that collected for other inputs. In addition, respondents report how many workers worked more than, or less than, 150 days for the farm firm during the year and whether any of these workers were migrant workers. However, as most agricultural production has been concentrated into larger production units, hired labor has become more important. The information collected does not identify how much labor was paid and unpaid or what proportion was family, local or migrant, and labor secured through a contractor is excluded. Moreover, no data are collected on worker benefits, tenure of workers or worker

ethnicity. These are data that might be relevant for policymaking or of interest to social and economic observers.

An expanded list of questions about labor may not be as relevant to agricultural production activities as to broader social and economic issues. However, if the COA is made into a comprehensive survey that seeks to satisfy all requests for useful information, it will lose its focus on farm firms and also become burdensome for respondents. If additional information is needed or wanted, the case for a special sample survey can be made on the basis of its individual, but separate, merits.

Geo-referencing. All agricultural production takes place in geographic space. And each geographic space where production takes place is unique, with characteristics different from other places where the same kind of production occurs. At the same time, such spaces exhibit characteristics that are similar to other spaces where the same kind of production occurs. These similar



geographic characteristics provide bases for aggregating information across space that are different from the political boundaries (counties and states) now used to publish aggregated COA data. For example, characteristics such as watershed, soil type and precipitation amounts and distribution could be used to illustrate the impact of agricultural production activities on environmental amenities. Geo-referencing would be invaluable in program design related to air quality, water quality and soil erosion. Although we are not well-

enough informed to anticipate all of the geographically interesting questions that could be addressed with geo-referenced data, we anticipate that interest and use would be high.

Another argument in favor of establishing geographic reference points for farm fields and facilities is that they could be used by NASS and a variety of other agencies that collect data about farms and agricultural activities. If such data were geo-referenced to both the site and the farm firm, then another agency would not have to collect the same information again. Also, information about a site from several sources could be used to evaluate the credibility of new information about the site. In the extreme, all the agencies with an interest in a particular

agricultural site could coordinate their data collection efforts to reduce the frequency of contact with the farm operator and minimize duplication of effort.

It is feasible to develop a flexible method for geographic aggregation through geographic positioning technology. Any location can be assigned a geographic reference point (longitude and latitude) simply by visiting the site with a geographic positioning system (GPS) receiver and recording the location. This information would then have to be linked to the farm firm that controls agricultural activity at that location. Although this process would be very expensive to initiate and conduct independently, it is likely that a significant amount of this effort has already been done. Several agencies, such as the Farm Service Agency, the Natural Resource Conservation Service, the Risk Management Agency, the National Resource Inventory and state departments of agriculture have already established geographic reference points for some fields and facilities under their regulatory jurisdiction.

An argument against the use of geographic referencing of farm fields and facilities is the potential for compromising the privacy of the farm operator. This is a powerful argument and it already applies to the other data collection activities of USDA and state departments of agriculture. Geographic referencing could increase the potential for compromising privacy. However, Canadian experience suggests that geo-referenced data can be used for many policy-relevant analyses where the publication of the results does not identify a farm. For example, in one study each Census farm was geo-referenced, and the ratio of livestock to available land for spreading manure “close to the farm” was calculated and mapped. The maps did not reveal the information relating to any geo-referenced farm.²³

To avoid any opportunity of releasing confidential data from records with geo-references, NASS might wish to consider establishing a geo-spatial analysis group that would prepare tabulations and conduct special studies for users on a cost-recovery basis. Once demand for geo-referenced data has become institutionalized, annual revenue generated from this activity could more than pay the costs of the geo-tabulation and analysis group. Done this way, geographic referencing would not increase the potential for compromising privacy because no users would ever see the observation for a single farm, and the analysis by the geo-tabulation group would show only summary data.

RECOMMENDATION 8.2

NASS should evaluate information collected in the COA about farms and farm operator households for relevance to the business of farming and for responsiveness to changing needs of users.

Strategies for implementing this recommendation:

- Prioritize information collected in the COA about farms and farm operator households to minimize respondent burden. (*See Criteria for Census Content Development, this chapter.*)
- Focus information collected in the COA on the cost and quantity of inputs used, the quantity of agricultural outputs sold and the revenue derived from such sales. Focus information about farm operator households on the social and economic status of the households. Change the questionnaire over time to reflect evolving policy interests.
- Continue to collect and refine information with significant policy implications.
 - Separate working-land from land-in-preservation programs, including government programs (e.g., Conservation Reserve Program and wetland preservation programs) as well as private versions (e.g., Nature Conservancy).
 - Report conservation payments as a separate category on the COA form.
 - Expand farm labor questions to include the number of farm workers hired through labor contractors.
- Limit questions about practices to a few significant technological or relationship questions such as tillage practices, organic farming, on-farm production and use of bio-fuels, production and marketing contracts. Obtain additional information about practices on farms through limited-sample surveys, such as ARMS and Census “follow-on” surveys.
- Explore the potential for geographical referencing of COA data to expand the utility of those data. Contact agencies within USDA and state departments of agriculture to determine the current extent of and interest in geographic referencing. Convene meetings of agencies with an interest in geographic referencing to establish a uniform system of what geographic features (fields, facilities, residences, etc.) are to be referenced and how they are to be linked to the farm firm. Reevaluate present data security systems to consider their efficacy for a

national geographic reference data bank. Assemble geographically referenced data on agricultural activities in a national data bank. Provide the capacity to provide tabulations and the capacity to provide analytic reports on a cost-recovery basis.

- Consider a menu of questionnaires that address the diversity of issues in agriculture and the diversity of target populations for which the issues are important. NASS could design modules and skip patterns so that additional information is collected from operators for which the criteria apply. This would be the first step to a different set of modules being mailed or sent electronically to different target groups on the NASS mailing list.

Creating linkages to other federal datasets

Background. The COA focuses on the agricultural production activities of farms. Farms are made up of people, households, facilities, inputs, outputs and markets. The COA asks questions about each of these, but emphasizes inputs, outputs and revenues. A number of other surveys, by a variety of agencies, also collect data about farms and farm households. Some of the data are social, some economic and some behavioral (conservation practices, etc.). To a degree, these efforts to collect information about farms are duplicative and redundant. For example, how many times is it necessary to ask for the income category of the farm family? The key to assigning meaning to farm-based data is to identify the “farm” with which it is associated. However, there is no uniform method of identifying the farm of interest for more than the survey at hand.

Every agency that collects data from farms has a method of identifying a farm or a farm operator. USDA may be close to developing a farm identifier through the inventory of identified farms maintained by NASS. The panel recommends that the system NASS uses be made compatible with the needs of other agencies. Such uniform identification would permit cross-verification of data among agencies. This sharing could reduce the respondent’s burden of providing data. However, any sharing of data must be consistent with agreements with respondents who provided the original data. The potential complexity of this task may require a significant research investment, with special emphasis on avoiding any possibility for compromising the confidentiality of individual farm data.

The value of COA data is maximized when it is collected in a manner consistent with other surveys within NASS and other agencies (e.g., NRCS, IRS). For example, with respect to consistency, supplies are a separate item on IRS Schedule F and in the NASS Agricultural Resource Management Survey (ARMS), but are lumped with repairs and maintenance in the COA. Because many operators who refer to records to respond to the COA likely draw from records systems designed to meet Schedule F requirements, using consistent categories would reduce respondent burden. At a minimum, consistency is needed between questions in COA and ARMS questions.

Data must also be made accessible in a way that allows analysts to define categories in the way they want. As examples, flexibility to allow users to custom design cross-tabulations of cash receipts by form of ownership, or apply Economic Research Service (ERS) typologies defined by combinations of household income, gross farm sales, primary occupation and whether the operator is retired, are needed. Plans for consistency and accessibility should also anticipate interest in using data files in time-series research and should improve the electronic capacity to build time series. Examples cited by stakeholders were the availability of production contract data beginning in 1969 and off-farm work data from 1929, which requires researchers to collect data manually from hard copies. Though not originally designed for panel data, building the capacity to link data to generate time series would increase COA value.

RECOMMENDATION 8.3

NASS should take the lead to organize a federal interagency committee to research how government agencies might develop a standard system of individual farm identification while protecting farmer confidentiality.

Strategies for implementing this recommendation:

- Develop a uniform system of farm identification so that all data collected for or from a farm is compatible with all other data collected for or from that farm. Once a uniform identifier is adopted, then each agency would use this same identifier in all its transactions with that same farm firm. Since farm firms change and enterprises are added and deleted, a given identifier must specify the date to which the data relate.
- Link other datasets (e.g., FSA administrative and BLM data) to the extent possible to reduce respondent burden and enrich the dataset, while assuring that individual operators will not be identified.

Capitalizing on other agricultural data and surveys

Background. The COA does an excellent job of documenting what is taking place on farms, that is, in quantifying farm operations and production by enterprise in scattered geographic locations. This is important information. But changes in agriculture and stakeholder interests mean that data shedding light on farm families' economic well-being, agricultural land use and agricultural practices are increasingly important. While the COA captures some data on the farm household in addition to the farm business, it does a relatively poor job of characterizing the farm household and documenting activities and well-being in rural America. Rural America increasingly includes more households with little emphasis on production agriculture. At the same time, many farm decision makers now live in metropolitan areas.

Because rural and agricultural are not synonymous, careful thought must be given to the role of the COA relative to other possible data collection methods. The proposal by ERS and NASS for additional funding for a new Agricultural and Rural Development Information System is an example of an alternative data collection method.

Stakeholders will continue to be concerned about the environment, invasive species, bioterrorism, land use and stewardship practices. In the policy arena, what is happening on the land base becomes relatively more important. Changing tenancy and land ownership mean shifts in the methods of accessing resources. Asset control impacts farm entry and exit and is impacted by conservation and government programs. The organization of farms, particularly at the large end of the scale, is much more complex than in the past. While the COA collects data about acreages operated in multiple counties and across state borders, it does little beyond that to quantify the scope of these operations. The intricacies of decision making are lost. Knowing who makes farm decisions will be critical to formulating policy that succeeds in achieving public goals. Yet, understanding these inter-relationships requires a multivariate approach via ARMS or an ARMS-like survey, an approach not appropriate for the Census of Agriculture.

While the review panel did not evaluate the content, procedures and merits of the various COA "follow-on" sample surveys, it endorses the concept of sample surveys as an efficient means of capturing data important to understanding the evolving economics of agriculture, but for which complete enumeration is neither required

nor necessary. If any of the existing sample surveys were to be discontinued, the ability to describe and analyze the economic profile of the agricultural sector would be severely reduced.

Given the demand for detailed and specialized information, follow-on and/or concurrent sample surveys should be designed and sold as part of the funding needed to conduct an integrated COA data collection, analysis and publication program. A survey that "follows-on" the COA indicates that NASS is following the least-cost method of providing data that, while integrated with the COA data set, does not necessitate a complete enumeration to capture rare characteristics or provide local level tabulations.

RECOMMENDATION 8.4

NASS should continue using follow-on and other sample surveys to expand the limited nature of the COA.

Strategies for implementing this recommendation:

- Explore the most efficient and effective combination of the COA and follow-on sample surveys. The COA should be used to get a complete count of farms and collect farm firm and household data required and viable at the county level and these counts should sum to state and national totals. Use follow-on sample surveys to collect data (e.g., marketing practices and land ownership patterns) not needed or practical at the county level. This will reduce the size of the COA questionnaire and increase the response rate. Whenever possible, link COA data and sample survey data with common farm identifiers.
- Continue partnering with other agencies and stakeholders to determine high priority needs and data gaps.





CHAPTER 9

Sampling, Data Processing and Documentation of Methods

Overview

The review panel commends NASS for its conscientious commitment to data integrity and continuous quality improvement in managing the COA. This chapter discusses coverage adjustment, area-frame sampling, non-response adjustment, data editing, imputation, documentation and transparency. A key theme in this discussion is that an evaluation of the systems and survey instruments used in the 2007 COA and analyses of the data produced will generate considerable information to guide the development of these procedures for the 2012 COA. In managing the provision of public data, important goals are 1) the accuracy of the summary statistics and 2) the transparency of how the data were produced.

Improving coverage adjustment

Background. The count of the number of farms, as well as other statistics reported by the COA is fully adjusted to account for under-coverage (i.e., for the farms missed by the COA). This raises two important questions. 1) What can NASS do to reduce the list under-coverage in the COA? 2) What can NASS do to measure under-coverage better?

To address coverage issues, NASS uses a dual-frame estimation method. Farms in the area-frame sample are matched to those on the list frame. Non-matches are contacted again to confirm that they did or did not receive a Census form. The characteristics of cases that match and do not match are then used to model and estimate under-coverage.

NASS's dual-frame methodology assumes "completeness" and "identifiability." Completeness implies that every unit in the target population belongs to at least one of the frames in the study. This requirement is satisfied if one is willing to assume that the area frame is complete. Identifiability is the ability to discern whether or not a sampled unit from one frame could possibly belong to any other frame in the study.

The Census Mailing List (CML) and area frames must remain independent. Independence implies that one frame is guarded from the influences of the other. Only if independence is guaranteed can the area frame be used to estimate the completeness of the CML. In dual-frame

estimation, adding "Not on Mail List" farms to the CML prematurely can bias the estimation process by effectively changing selection probabilities.

The COA adjusts for non-response and under-coverage in an attempt to address the bias that could arise from these sources. Other potential sources of bias include errors due to interviewing, response, edits, the choice of non-response weighting classes, matching the area-frame sample to the CML and the integerization of weights. It is not clear that NASS examines all these sources of bias comprehensively.

The size of a farm is a key to explaining the degree of under-coverage, but by itself does not go far enough. For example, the small size of the average farm operated by Blacks, Hispanics or people under 25 years of age can not explain the large undercount of these types of farms, since equivalently small farms have higher coverage rates. For example, it is reported in Appendix C, Table A of the 2002 COA that farms operated by Hispanics are undercounted by 43 percent. The same table shows that this is larger than the undercount rate across all demographic groups for farms in every size category, which peaks at 33 percent for the smallest farm category (1 to 9 acres). Even though farms operated by Blacks, Hispanics or people under 25 years of age represent a small fraction of the farms and the acres farmed, their under-coverage seems to indicate a problem with the CML creation.

The area frame is treated as though its coverage is complete and correct. The review panel suspects, however, that there are farms on the CML that are not in the area-frame segments. Further, although non-matches are contacted to confirm their accuracy, it appears that no analogous quality check is used for matches, even on a sample basis. By treating the area frame as complete, it appears that no use was made of counts of farms that were on the CML but not on the area frame. Further, the review panel suspects there may be farms missed on both the list and area frames. In essence, NASS uses only two of the four cells of the 2x2 dual-frame matrix (CML x area frame). If the area frame is not complete, the amount of under-coverage is even greater.

The Chang and Kott²⁴ method of modeling the under-coverage rates is similar to that of Alho, Mulry, Wurdeman and Kim that was developed experimentally for the 1990 population census. In that application, a completely model-based adjustment method was deemed undesirable. Instead, a method that used the predicted coverage probabilities from an Alho-like model was used



to help form post-strata, within each of which the usual dual-system estimator was computed.

Chang and Kott apply standard model-selection procedures that employ overall measures of fit. To use the model results to adjust for under-coverage, the reciprocal of the estimated inclusion probability for a farm would be applied as a weight. Such a use suggests that an accurate fit for the probability of coverage is more important for farms with low estimated coverage rates than for those with high coverage rates.

The 2007 COA may not adequately cover new farms (births, late adds) initiated following the 2007 June Agricultural Survey and 2007 Agricultural Coverage Estimation Survey, but before the COA. Some of these farms may be captured through the mailing to screener non-respondents, but others may be missed. To reduce this likelihood, it is important that the reference data for the list enumeration be the same as that for the area enumeration.

The final coverage-adjusted weights were restricted to the interval [1,6]; that is, all numbers greater than or equal to one but less than or equal to six (Appendix C, page 9 of the 2002 Census of Agriculture, June 2004). Is this, or should this be, consistent across states? For example, Fetter and Kott (page 53) show data for a particular state with an “upper boundary of 5.” Should there be a fixed upper bound after calibration?

The matching and un-duplication concepts in NASS’s dual-frame estimation are blurred. In the usual application, a matching process would identify sampled units in the area frame that are also on the list frame. The remaining (non-matched) units would be those that were missed in the COA enumeration. In this context and under the completeness assumption, non-matched units are those belonging to the sampled area-frame segments not found on the CML. In general, an un-duplication process would remove from the list frame a second or third unit that corresponds to another unit (the primary one) already on the list frame. Hence, un-duplication removes duplicates from the list frame.

According to NASS, “un-duplication” is defined as all activities related to the identifiability assumption. For the estimator used by NASS, elements of the area frame are

reviewed and included in the estimation process only if they are not found on the list frame. Here, the un-duplication process removes from the area frame sampled units included on the list frame. Sampled units remaining on the area frame are used to estimate under-coverage. According to one study, un-duplication is typically the leading source of non-sampling error in dual-frame estimation.²⁵ Successful un-duplication of the CML (with itself) is critical for avoiding over-coverage due to duplication. In addition, a corresponding matching process (between multiple list frames) was not described in the materials the review panel received.

RECOMMENDATION 9.1

NASS should re-evaluate its coverage adjustment procedures and how the need for coverage adjustment might be reduced.

Strategies for implementing this recommendation:

- Consider developing a total-error model for the estimation procedure based on data from the 2007 COA. Collect data and try to evaluate the effect on census bias from errors due to matching, interviewing, response and non-response, edits, the choice of non-response weighting classes, etc. For example, a sample of matches from the area list to the CML would provide information on the accuracy of true matches. The effect of integerization can be evaluated from data already available from the 2002 COA. Consider a program of experiments in the 2007 COA that will allow for estimates of bias resulting from sources beyond non-response and under-coverage.
- Investigate why farms operated by minorities or young people are so unlikely to appear on lists that constitute the CML. One approach would be to compare the characteristics of farms (e.g., years in operation, type of crop grown) operated by minorities or young people with farms of comparable size but operated by farmers who are not members of one of these groups.
- Continue exploring alternatives to the area-sampling scheme to capture more minorities and younger operators in the sample. For example, regions where the concentrations of Hispanic (or Black or under



25 years) operators are greater could be over-sampled. If one weights properly, (the expected value of) the under-coverage rate may still be about the same for these groups, but it should be more accurate.

- Document how a farm or operator ends up on the CML or any of the lists used to develop it. Explain efforts to remove duplicates from the final list and to measure the extent of any remaining duplication.
- Consider dual-system estimation as a method for estimating under-coverage and making a coverage adjustment. If a completely model-based approach is deemed undesirable, explore models such as those developed by Chang and Kott for forming post-strata. For a given model, NASS could estimate the probability of not being on the CML for each member of the list. NASS could then form post-strata based on similar values of the estimated probabilities. As a result, under-coverage could be estimated separately for these homogeneous groups.
- Consider whether some alternative method of model selection that gives more importance to the low estimated probabilities in the Chang and Kott model might provide better results than standard model selection procedures. An example is a method developed by Caples. For NASS, the model selection procedure will “penalize” lack of fit for high probabilities of not being on the CML more seriously than for low probabilities.
- Investigate potential coverage issues arising from new (birth) and exiting (death) farms following the 2007 June Agricultural Survey and 2007 Agricultural Coverage Estimation Survey, but before the 2007 COA. As a start, try to estimate the frequency of such births. If data from the 2008 June Agricultural Survey are available in time, NASS may be able to project how much of the estimated differences in totals from the 2007 June Agricultural Survey minus 2007 Agricultural Coverage Estimation Survey to the 2008 June Agricultural Survey might have occurred by the time of the 2007 COA. If this strategy is feasible, it could be tested on data from the 2002 June Agricultural Survey, 2002 Agricultural Coverage Estimation Survey, 2002 COA and 2003 June Agricultural Survey.
- Explain matching and un-duplication processes in a way that improves clarity.
- Use results of these investigations and analyses to guide development of the 2012 Census.

- Measuring non-sampling error can be improved with every new COA. Improvements in technology allow for improvements in methods for measuring the various components of error. For example, new computer technologies allow better and more accurate matching of files, which means that matching error in the dual-system estimation can change in magnitude from one Census to the next. Even error components that were small in previous surveys could become more important for subsequent Censuses. Therefore, continuous monitoring and improvement are essential.

Improving area-frame sampling

Background. According to Chang and Kott, logistic regression modeling is used to predict the probability of not being on the mail list for California.²⁶ They describe a “US-level fit” to allocate the area sample. In the authors’ 2004 paper, they state that “since NASS sample designs are independent across states, it is tempting to fit a separate logistic model for each state.” They recommend against this and propose that a single 48-state model be used, as it provides a larger sample size.

The 2002 COA states that the percentage of farms missed in the COA varied considerably by state.²⁷ Thus, it appears that NASS’s modeling efforts for not being on the mail list could be more targeted with respect to geography. Moreover, the area-sample allocation favored precisely those farms very likely to be on the CML—farms in strata that are intensely agricultural.²⁸

According to NASS staff, the counties in the area-frame sample are selected geographically, mainly in a serpentine fashion. That is, the counties are ordered so that consecutive counties on the list are mostly contiguous.

The geographical (serpentine) ordering of the substrata makes it more likely that counties from different parts of the state will be selected into the sample. However, at least in household surveys, contiguous counties can be very different in their average characteristics. For example, the county or counties containing Philadelphia may well be more like those containing Pittsburgh, than the suburban or rural counties just outside of Philadelphia. In household surveys, a stratum may contain counties from all different parts of the state—not necessarily counties that are geographically proximate.

RECOMMENDATION 9.2

NASS should continue to improve its procedures for area-frame sampling.

Strategies for implementing this recommendation:

- Refine modeling efforts with respect to geography. Because data are sparse at the state level and the percentage of missing farms varies widely by states, NASS should consider modeling the data for a combination of similar states. The definition of similar states could use known information on crops and livestock, similar to the procedure used to define the thirteen regional versions of the sample form.
- Target strata that are both intensely and not intensely agricultural when allocating the area sample. It appears that the farm operators in the hard-to-capture groups are located in non-intensely agricultural areas.²⁹ This recommendation should allow NASS to better capture farms not likely to be on the CML.
- NASS should explain or evaluate why the serpentine method for identifying counties in the area frame is the most efficient method.

Adjusting for non-response

Background. Documentation in the 2002 COA suggests that size accounts for much of the variability in response rates.³⁰ The weighting classes for the “non-must” cases are defined by size and county.

When there is no response to the screening questionnaire, the potential farm is not included on the CML, but a census form is still mailed. If the operator responds to the COA, then he or she is assigned a non-response weight of 1 and removed from the undercount measurement. If the operator does not respond to the COA, the farm is treated as though it does not exist on the CML and there is no non-response adjustment. These cases are currently accounted for through the coverage adjustment via calibration. From the screening operations, 92,203 questionnaires were returned by the U.S. Postal Service because they had undeliverable addresses. They were excluded from further Census mailings.

Treating non-response via weighting classes will not cause a bias if response is completely at random within the classes. Although farm size accounts for much of the variability in response rates, some variability by type of owner (full/part/tenants) and his or her demographic characteristics remains.

Of those who respond to neither the screeners nor the COA, some may be farms. Such cases are treated as if they are not on any list and are addressed by the coverage adjustment. It is not obvious that these cases are better accounted for through the coverage adjustment (calibration) than through a non-response adjustment. A model for non-response might be applied as in the post-enumeration surveys for population censuses conducted by the Census Bureau in 1990 and 2000.³¹ The coverage adjustment would be applied later, but would address a smaller (weighted) number of missed farms. Thus, less coverage adjustment would be required.

Some undelivered questionnaires may be farms. In an analogous situation in the 2000 population census, Census Bureau enumerators visited a sample of households for which forms were returned as undeliverable by the U.S. Postal Service. About 22 percent were estimated to be occupied.³²

RECOMMENDATION 9.3

NASS should continue to explore improved methods for adjusting for non-response.

Strategies for implementing this recommendation:

- Explore alternative methods of forming the non-response weighting classes in an attempt to minimize the bias.
- Follow up with a sample of the cases that do not respond to screeners and survey in the 2007 COA to determine how many are farms. Explore modeling the probabilities that such cases are farms and using those probabilities in the non-response weighting.
- Follow up in person a sample of cases with undeliverable addresses in the 2007 COA. This method would permit an estimation of the number of farms among them.

Census editing procedures

Background. NASS has learned and continues to learn how to improve its COA processes. It has developed a multi-component editing system to ensure the quality and consistency of data reported on individual census forms. The system includes 1) basic range and outlier edits, 2) edit logic development as specified in Decision Logic Tables, 3) batch edit of the raw data, 4) interactive update or data review by knowledgeable staff and 5) a micro/macro analysis system that provides analysts with tools to analyze aggregate totals and to correct inconsistent records identified through editing. This system contributes substantially to the quality of the final

data products. In addition, NASS plans significant editing improvements for 2007: increased staff, centralized staff responsibilities, subject-matter specialists to write edit logic for the Decision Logic Tables and substantially improved speed of the Decision Logic Tables' executable code. NASS also developed a tool (Data Review) to display current data from a single record along with previously reported survey data, data from a previous census, or control data found on a list frame. Further advances are possible for 2012 if NASS takes advantage of its experience with the 2007 COA by producing critical system diagnostics to delineate the costs and time associated with the implementation of each of the system's components.

Concerns exist about the need to improve the efficiency of the editing operations (staffing, finances and timing) and the amount of analyst intervention in the editing system. Costs associated with the various editing operations are not apparent. Furthermore, information about the editing process does not appear to be available to data users.

RECOMMENDATION 9.4

NASS should continue to refine census-editing procedures based on evaluation of experiences with the 2007 COA.

Strategies for implementing this recommendation:

- Develop a plan to evaluate components of the 2007 editing system and the financial/staffing costs associated with each component. Develop a program of quality and cost measures that identify where inefficiencies occur and where improvements can be made. A focus of this assessment should be an evaluation of the cost and benefits of manual versus machine-based editing. This includes developing a quality control program to measure the extent and impact of manually editing the data. The current editing system appears to require substantial staff interventions. Minimizing human intervention should increase efficiency and reduce costs, and thus should be a priority for NASS. Emphasizing web data collection can also help reduce errors in the data. In the interest of time and resources, an appropriate strategy may be to use analysts to review only records that require substantial editing or are associated with large farms rather than to correct all records failing edit.
- Analyze the edits made to the 2007 COA with the goal of improving the quality of the questionnaire designed for the 2012 COA. A large number of edits

to a question suggests the question needs to be examined for improved wording or elimination from the 2012 COA. If changes are made in the 2007 editing system, sufficient time should be made available for testing the complete edit system, including a "live test" on Census test data.

Item-level imputation

Background. For the 2002 COA, an editing process assessed individual Census forms for reasonableness and completeness. This process determined whether to accept, delete, impute or alter the reported value for each data record item. Based on the results of the editing process, NASS reported that only 10 percent of farm questionnaires initially were complete across all items for the 2002 COA. NASS used statistical procedures to impute (supply) values to items classified as either inaccurate via editing or missing altogether. Whenever possible, imputations, deletions and changes made by the editing system were based on related data on the respondent's questionnaire. For items such as operator characteristics, available data for that farm from the previous Census were used whenever feasible, and values available from other NASS surveys were used where applicable. When these and similar methods were not available and values had to be supplied, the imputation process used donor information reported by a similar farm operation in the same state or in a neighboring state that had characteristics similar to those of the farm operation with incomplete data.

According to NASS, a review of the imputation methods used for the 2002 COA reveals strong indications that additional control of the imputation cells by size and type of farm would improve the overall quality of the imputation process. NASS is currently conducting research into how best to impute missing items for the 2007 COA. A second issue from 2002 is that item-level non-response metrics were not made available to data users. Thus, data users do not know what proportion of an item's estimate was imputed versus actually reported.

RECOMMENDATION 9.5

NASS should increase and broaden its research on item-level imputation. *(This recommendation is a component of the Recommendation 6.3.)*

Strategies for implementing this recommendation:

- Explore a broad class of efficient imputation procedures. These methods include, but are not limited to, "hot deck" donor pool imputation (rather

than relying initially on “cold deck” procedures) and propensity scoring. The goal is to establish the best approach for imputing items in a statistically optimal yet cost-efficient manner for both 2007 and 2012. Imputing items better in 2007 will introduce a confounding effect on 2002 to 2007 item trends. However, this research should allow the 2007 imputation methods to be used again in 2012, thus reducing, if not eliminating, the impact of changes in imputation on 2007 to 2012 trends.

- Conduct a “quality of imputation” analysis to assess how well the 2007 methods performed. Similar to the research recommended for choosing among competing methods for 2007, a large-scale simulation study is recommended, except finalized 2007 data would be used. This analysis can serve as a simulated non-response bias analysis using 2007 reported data with some items assumed to be missing and then to be imputed and compared to actual responses.
- Analyze the incidence of data imputation made to the 2007 COA to improve the quality of the 2012 questionnaire. A large number of imputations to a question suggest that the question needs to be examined for improved wording or elimination. (See *Census Editing Procedures and Documentation and Transparency sections, this chapter and Content Development and Testing section, Chapter 8.*)
- Analyze the 2007 information to determine ways to lower item-level imputation rates for 2012.



In summary, the review panel encourages NASS to review its approach to item-level imputation to ensure that the definitive, all-encompassing research is done now for 2007, so that the best imputation method can be chosen. Once chosen, we recommend using it again in 2012 (after conducting the simulated non-response bias analysis using 2007 data recommended) to avoid introducing methodological change due to a revision in approach to item imputation (i.e., to minimize distortion of the 2007 to 2012 trends due to changes in how items are imputed in both 2007 and 2012).

Documentation and Transparency

Background. Accurate use of data requires public documentation of data definitions, derived variables and flow of data through the processing systems. Documentation makes data users aware of potential constraints in using the data and may reduce the incidence of inappropriate use of the data. This documentation is also critical for ensuring that the data are replicable.

The review panel concurs with the GAO that some gaps exist in the documentation and transparency of some processes used in the COA.³³ The review panel also notes 1) that Ron Bosecker, Administrator of NASS, states in his letter to GAO that documentation will become more thorough; 2) that NASS makes available to researchers on a restricted-use basis datasets used to assess coverage, response and other biases and 3) that NASS makes its research available to the statistical community via publications in peer-reviewed journals and

presentations at both national and international professional meetings.

RECOMMENDATION 9.6

NASS should provide documentation so that all aspects of data collection and compilation are transparent and replicable. (See *Recommendation 6.4.*)

Strategies for implementing this recommendation:

- Thoroughly document the methods used to edit and impute data and make this documentation available to public users. The training, guidance and decision rules used by analysts and the effect of decision rules on estimates also should be documented for users. Flags should identify the type of edits and imputation implemented as well as the reason for the edit and imputation.
- Provide summary statistics on the incidence of data editing, imputation and suppression. Similar to the decennial census of population and housing, an item-by-item reporting of the share of responses that are imputed should be provided, as well as the aggregate number of imputations. This is consistent with standard practice, although it should be done in a way that does not allow a user to deduce confidential information.

- Report publicly rules for suppressing data due to a lack of observations and provide summary statistics on the incidence of this type of data suppression with the goal of improving future questionnaires or improving/instituting collapsing rules. Data are usually suppressed either to protect confidentiality of individual respondents or because an insufficient number of cases exists to have confidence in the statistical reliability of the data. A large number of data suppressions to a question may suggest that the question should be examined for improved wording or elimination from the 2012 COA.
- Document matching and un-duplication processes, as well as how confirmed duplicates in the list frame are treated.
- Make the documentation available to the public in a series of reports. These reports would make the information available to the public, and they would become a source of institutional memory. The review panel concurs with GAO that data documentation needs on shorter COA publications can be achieved best by providing electronic links.
- Make available to researchers on a restricted-use basis datasets used to assess coverage, response and other biases.





CHAPTER 10

Census Output Products

Overview

The object of all the effort and taxpayer funds expended on the COA is the final package of public products. For this reason, planning for these products should be integral to the entire COA process.

Prior to 2002, data collected by the COA were released as tables and graphics and printed in Census publications. For the 2002 COA, NASS put these publications and all their content online and made them easy to access and download. NASS has also experimented with ways to make the data more available to researchers, via tightly controlled data labs, to re-aggregate and re-configure data to meet unique needs. NASS has also made special tabulations for other agencies and users.

With a new generation of data users accustomed to using advanced information technology to access and manipulate data, the usefulness of COA data can be expanded by making the data more accessible, with the flexibility for users to define and create data products that meet their unique needs.

Rethinking COA products and services

Background. The information age provides new opportunities for NASS to make COA data and information more readily available and more useful. The trend toward computer literate data users and widely available, user-friendly data products will continue to shape all units of government. By 2012, even more people will likely rely on electronic data, graphics and information rather than paper copies. This generation of consumers will demand “answers” in a “just-in-time” framework, rather than getting acquainted with the nuances of pre-packaged Census tables. The rapidly rising levels of computer literacy will lead Census users to expect data and graphics to appear with “three clicks of the computer mouse.” Despite the advances in computer technology and computer literacy rates, some COA data users will still prefer paper copies. The digital divide, while shrinking, will still be present in 2012. Thus, NASS faces the dual challenges of providing for both types of users.

Several possibilities exist for dealing with these dual challenges.

- PDF copies of previous Censuses could increase the utility of trend analysis and change across time.
- Google, some other commercial firm, or the National Agricultural Library might be contracted to include the COA as part of its digital library. Short of such an alliance, a user-friendly search engine on the COA website will make it easier for users to find the data they desire.
- A FAQ button on the main COA website would reduce the amount of time users spend searching for the data they need.
- A “Quick Stats” type of functionality on the COA website could provide users with a pop-up menu of what is available or how to perform a particular search.
- Linking COA output products with other censuses and secondary datasets would improve the utility of COA data. For example, being able to link the COA to existing industrial censuses would permit improved information about the welfare of rural America.

In short, a major investment is warranted in designing output products and services that are user-friendly and responsive to sophisticated users who can themselves add value to basic statistics. While it is critical that NASS maintain respondent confidentiality, emerging new statistical analytical methods can permit rather sophisticated analysis that protects identity of respondents when sub-cell numbers fall below a specified threshold. In designing such products, NASS must give thought to both data and what users want to be able to do with the data. Computational procedures need to be designed that facilitate creative uses of Census data. Such a re-conceptualization of COA data products and services will enhance their value to users, build a stronger support base and support the use of Census products to reach potential respondents.



RECOMMENDATION 10.1

NASS should undertake a comprehensive re-conceptualization of data products and services that anticipates information-technology capabilities and interests of users by 2012. (See Recommendation 6.2.)

Designing output products in response to user demands

Background. The traditional approach to a COA is much like traditional farming: produce the product and then think about how to market it. For many agricultural and consumer products today, however, the process starts with figuring out what the consumer wants and then working backward to assure that the system is designed and managed to fulfill that want. This is the process suggested for NASS. It is critical to find out what existing and potential users of COA data need and want.

These needs and wants usually take two forms: 1) specific data items and 2) the ability to use those data items in ways that meet user needs. Various other recommendations in this report deal with reaching out to potential users of COA data. The recommendation below suggests starting with the data and data services that COA users want and then working backwards through the processing, questionnaire design and survey design to focus the entire planning effort on delivering what the customers want.

According to NASS, it has only anecdotal information about COA data use; nothing is systematically documented. Systematic recording of all input about uses of COA data is critical to guide content and product planning. However, recorded uses need to be augmented by in-depth market research to determine the depth, breadth and gaps of Census data use.

RECOMMENDATION 10.2

NASS should place primary emphasis upon designing output products that respond to user demand. (See Recommendation 6.7.)

Strategies for implementing this recommendation:

- Conduct a series of focus group meetings among major COA users to develop a matrix of optimum outputs, including current and new types of products and delivery systems.

- Survey potential users and stakeholders to determine the key products desired, expectations about data, formats desired and best vehicles for data release.
- Build strategic alliances with stakeholders who will defend the COA. Some in the agribusiness sector do not see the utility of the COA, and some commercial producers are wary of accurately completing COA questionnaires. Challenges to funding the COA will grow unless NASS is able to demonstrate a widespread demand for information from the COA that informs a wide range of decision makers.
- Consider how users can aggregate farms to meet a variety of geo-spatial needs. Demand for COA data on specialized topics and geographical areas, such as watersheds, multi-county and congressional districts will likely increase. Advancing technologies give NASS the opportunity to respond to that demand.
- Develop systems to track and document the uses of data from the Census.
- Give product designers a stronger role in coordinating the overall COA planning process. While this change is already underway, it requires a change in the mindset of COA planners.



Marketing Census products

Background. Rather than an event that occurs once every five years, the COA is, and should be seen as, an ongoing, continuous opportunity to raise public awareness of the importance of American agriculture. Because it is responsible for the COA, NASS should lead in educating the public and policymakers on trends, developments and issues that derive from analysis of COA data. An ongoing program of analysis of COA data would provide the fodder for a communication specialist dedicated to COA who could devise a marketing and communication plan that would include news releases, attractive brochures and other campaign materials that would educate the public about important issues in agriculture and the importance of the COA. In the past, NASS seems to have gotten significant publicity when the data were released, but then faded from sight until the next COA. This need not, and should not, be the case.

RECOMMENDATION 10.3

NASS should develop an ongoing communication strategy that keeps COA in the news. (See Recommendations 6.7 and 7.3.)

Strategies for implementing this recommendation:

- Develop a continuous, ongoing program of analysis that feeds a marketing campaign that models some of the products from the U.S. Census of Population and Housing. Materials such as fact sheets, news releases, profiles of women farmers or unique characteristics and trends that pique interest among the public and press would call attention to the importance of the COA.
- Integrate dissemination plans and strategies of COA data into the overall data gathering process. (See Recommendation 6.7.) Availability and visibility of COA products will improve participation rates and coverage. The theme, “Your voice, your future and your responsibility,” is a good marketing strategy and one that needs to be reinforced continually in all COA-related mailings. If the COA is to become a branded product, then this theme must be consistently applied to all communications. Repetition is critical in building a branded, easily recognizable and understood product.
- Make more effective use of the NASS Census of Agriculture Advisory Board. An important role of that Board is to inform key stakeholders of the value of the Census of Agriculture so they might more effectively intervene to justify the value of the COA in the eyes of the public and of policymakers.

quality and other data characteristics should be integrated into product design. (See Recommendation 6.4 and related discussion of transparency in Chapter 9.)

Increasing transparency

Background. With the emergence of smart technologies, increased analytical capabilities and changed client demand for electronic COA products, documentation assuring users of data quality is essential. It is important to report all sources of error in data collections. In particular, users need to know more than has typically been available about survey operations and non-sampling error in surveys. Transparency will enhance confidence in the data, improve product design and increase COA data use. By 2012 computerization will likely be a major driver of how data are collected, used and disseminated. COA product designers are encouraged to embed transparency in data products so that users, including those who wish to manipulate the data to fit their own needs, will be reminded of the quality characteristics of the data. Information about data





ENDNOTES

- ¹ C-FARE is a non-profit organization dedicated to enhancing the application of economics to food, agricultural and resource issues at the national level. Its members represent a wide range of public and private sector interests.
- ² Much of the information in this section comes from the 1997 USDA/NASS Census of Agriculture, History, Volume 2, Part 4, Appendix B and from a pre-published draft of the 2002 Census of Agriculture, History, Appendix B.
- ³ Gardner, 1983.
- ⁴ Ray Bollman, Agricultural Division, Statistics Canada.
- ⁵ Public Law 105–113, Title 7, United States Code, Section 22049.
- ⁶ Information in this section taken directly from *2002 Census of Agriculture*, Volume 1, p. viii, and from legislative information provided by NASS.
- ⁷ Provided by George Hanuschak, USDA/NASS, to John Lee via email dated November 2, 2006.
- ⁸ *2002 Census of Agriculture*, Volume 1, pp. vii–viii.
- ⁹ For specific examples of Census data use and users, see Appendix C.
- ¹⁰ For examples of improvements and changes to the 2002 and 2007 COAs, see Appendix D.
- ¹¹ U.S. Government Accountability Office, 2005.
- ¹² de la Puente, 2006.
- ¹³ de la Puente, 2006.
- ¹⁴ Dillman, 2000.
- ¹⁵ Couper et al., 2001.
- ¹⁶ Zanutto, 2001.
- ¹⁷ Bosnjak and Tuten, 2001.
- ¹⁸ Dillman, Tortora et al., 1998.
- ¹⁹ Solomon, 2001.
- ²⁰ Roe et al., 2005.
- ²¹ Roe, 2005.
- ²² Criteria provided by NASS.
- ²³ For examples, see Beaulieu and Bédard (2003), Beaulieu, Bédard and Lanciault (2001) and Beaulieu (2001).
- ²⁴ Chang and Kott, 2004.
- ²⁵ Nealon, 1984.
- ²⁶ Chang and Kott, 2005.
- ²⁷ Page C-8, Appendix.
- ²⁸ Chang and Kott, 2005.
- ²⁹ Chang and Kott, 2005.
- ³⁰ Table A, Appendix C.
- ³¹ U.S. Census Bureau, 2004, Section 1, pp. 6-5 to 6-9.
- ³² U.S. Census Bureau, 2003.
- ³³ U.S. Government Accountability Office, 2005.
- ³⁴ The examples came directly from a document prepared by NASS at the panel's request.





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GLOSSARY

Terms

Area frame: a frame having entries that are defined by geographical boundaries.

Bias: the difference between the average (mean) value of a statistic and the parameter it is estimating.

Census Mailing List (CML): a list frame of farms developed by NASS by combining lists from a variety of agriculture-related sources and then un-duplicating.

Cold deck imputation: an imputation method in which each missing value is replaced by a value from a similar participant in a previous survey. These are rarely used today, but were among the earliest imputation methods used.

Coverage: the extent to which the sampling frame includes all the units in the target population and no units not in the population.

Coverage adjustment: a mathematical procedure that attempts to correct the bias resulting from imperfect coverage by the sampling frame.

Data editing: procedures used to attempt correction of measurement error in survey data.

Dual-frame survey: a survey in which the sample is drawn from two possibly overlapping frames. This method can be used when no single frame exists that covers the entire population.

Dual-system estimation: an estimation procedure used for estimating the size of a population by sampling from the same population on two occasions. The extent of the sample overlap provides information about population size.

Enumeration: a complete count.

Estimation: process by which sample data are used to indicate the value of an unknown quantity (a parameter) of a population.

Frame: a list of units or groups of units in a population that can be used for sample selection. The list should collectively cover the whole population, and the entries of the list must not overlap, so that every unit of the population belongs to exactly one entry in the frame.

Hot deck imputation: an imputation method in which each missing value is replaced by a value from a similar participant in the same survey.

Imputation: prediction of a missing value or values for a sample unit based on some procedure, for example, by using a mathematical model in combination with available information.

Item-level imputation: prediction of a missing value for some, but not all, items of a sample unit based on some procedure. One may use information from items that are present for the unit as a source of information for the procedure.

Lifestyle farms: a term used loosely to describe farms whose operators do not depend on farming for a living but who engage in some agricultural activities because of their preference for country living or rural lifestyle.

List frame: a frame whose entries are individuals; e.g., farms or farmers.

Sample: a subset of the population selected as the group from which data will be collected.

Survey: a set of procedures designed to obtain data from some or all members of a population.

Strata: subsets of the population. All units in the population belong to exactly one stratum.

Under-coverage: the bias in an estimate that results from failure to include in the frame all units belonging to the target population.

Total error model: a mathematical description of the average (mean) of the squared difference between a statistic and the parameter it is estimating. This will include components of variability and biases arising from various non-sampling errors, such as under-coverage, imputation and non-response.

Acronyms

ARMS: the Agriculture and Resources Management Survey conducted by NASS for ERS.

BLM: Bureau of Land Management, Department of Commerce.

Census: unless otherwise noted, refers in this report to the Census of Agriculture except when reference is to a generic census. Used in this report interchangeably with COA.

CES: Cooperative Extension Service.

C-FARE: Council on Food, Agricultural and Resource Economics.

COA: Census of Agriculture, used interchangeably in this report with Census.

ERS: Economic Research Service, an agency of USDA.

FSA: Farm Service Agency, an agency of USDA that services farmers with offices in most counties.

NASS: National Agricultural Statistics Service, an agency of USDA responsible for the census of Agriculture and a wide array of agricultural surveys and statistics.

NRCS: Natural Resources Conservation Service, an agency of USDA, responsible for conservation of soil, water and other natural resources.

USDA: United States Department of Agriculture.





APPENDIX A

Review Procedures and Methods

Procedures for this review were designed to assure objectivity, independence, freedom from conflict of interest and the highest possible level of professional competence. In general, procedures were similar to those used by the National Academies of Sciences (NAS).

Several times during the winter and spring of 2006, NASS officials met with the C-FARE Board of Directors to frame the content and objectives of the proposed review. Agreement was reached on a statement of task and scope of review, along with a budget, and the two parties signed a contract on May 5, 2006. After that, began the process of assembling a review committee and panel of experts. The strength of C-FARE, relative to the review, is its familiarity with, and access to, social-science expertise in academia, government and the private sector. Utilizing that strength, the board selected a Chair of the review committee. The Chair, working with the C-FARE Board selected a Review Director. The Review Director and Chair then selected sixteen members of the review panel, based on two criteria: 1) an appropriate range of expertise and 2) a balance of perspectives.

The exact range and mix of expertise required on the panel flowed from the five (consolidated into four) major issue areas NASS identified for review. Each panel member was chosen for his/her ability to address one or more of these major issue areas. The resulting mix represents a variety of statistical specialties and specialties within economics and the other social sciences.

Panel members were also selected to provide a balance of experience and perspectives. Since coverage of small and minority-operated farms is a significant issue for the COA, several panel members—having the prerequisite expertise—were selected with that experience, interest and perspective in mind. At least one panel member brought a business-sector perspective and experience to the panel. In the end, the panel represented a high level of expertise and a balance of disciplinary, gender, ethnic and user experience and interest. Once selected, each panel member served as an individual expert and not as a representative of any group, organization or interest.

Prior to confirmation, each potential panel member was screened for conflicts of interest. Each candidate answered a set of questions and was verified by NASS as having no contractual, advisory or financial links (past or

present) to NASS or the COA that would constitute a conflict of interest. USDA employees were ineligible to serve as panel members. Once the entire panel was assembled, the full list of members was checked one final time by the C-FARE Executive Committee and NASS for conflicts of interest.

Prior to the beginning of panel deliberations, the Review Director and Chair provided members the charge, laying out individual and group responsibilities and expectations. They also provided a timeline with major benchmarks to assure completion of a satisfactory review by the March 1, 2007 deadline. NASS provided pertinent background materials pertaining to the COA and the issues under review. Finally, C-FARE publicized the review, including input provided by COA users and other stakeholders. (See Appendix B.)

The panel began deliberations in Washington, DC, September 18-20, 2006. It devoted the first half-day to public input from individuals and stakeholder organizations. The following day was devoted to presentations by NASS staff followed by questions from the panel. These information-gathering sessions were open to the public. To focus more intently on specific issues, the panel divided itself into sub-panels with a chair for each. Responsibilities were also assigned for cross-cutting issues that did not fit neatly into the boundaries of any single sub-panel. By the end of the first panel meeting, sub-panels had made a first cut at defining problems and issues around which they would deliberate and, possibly, make recommendations.

Between formal panel meetings, sub-panel chairs and panel members worked both independently and as teams via conference calls and email. All draft materials from all sub-panels were shared by email with other sub-panel chairs, the Review Director and Review Committee Chair. One purpose of sharing was to identify overlaps and gaps in issue coverage. Another was to identify issues of cross-cutting interest. Sub-panel chairs, the Review Director and the Review Committee Chair and Co-Chair also held bi-weekly conference calls.

To assure full access to needed information, NASS assigned a liaison, who responded quickly and completely to panel requests. NASS was not provided access to draft materials arising out of panel deliberations. However, the NASS liaison was asked to review the final manuscript for any errors of fact.

As the panel was being formed, C-FARE contracted with a writer-editor familiar with agricultural and rural issues.



He attended panel meetings and joined in conference calls to bolster his understanding of the issues under review.

Prior to the final panel meeting in Washington, DC, in November 2006, drafts of all parts of the final report were circulated to all panel members. These included drafts of deliberations and recommendations by the sub-panels. At the final panel meeting, panel members scrutinized, debated and refined these drafts. The Review Director reminded members of their right to file a minority report on any topic where agreement could not be reached. The panel reached consensus on most issues, but in two cases agreed only that there was no consensus within the group at this time and that further study was warranted.

Following the final panel meeting, the Review Director wove all the sub-panel and cross-cutting drafts into a complete and internally consistent report. That comprehensive draft was turned over to the writer-editor in December. The resulting edited draft was reviewed once more by the panel members in January 2007 and then sent to external reviewers. When all external and internal comments were addressed, a layout specialist completed preparation of the manuscript in February. On February 8, NASS officials were briefed on highlights of the forthcoming report. As required by the contract, a camera-ready manuscript was provided to NASS prior to March 1, 2007. NASS will publish the report without comment and release it to the public.



APPENDIX B

Stakeholder Input to the Review

As part of its review, the panel solicited input from professionals within the public, private and academic communities during an open public comment period. Efforts to contact COA stakeholders for public comment included email campaigns and individual phone calls to agricultural economists and other professionals in the agricultural community. Forums for public comment were held at the 2006 Annual Meeting of the American Agricultural Economics Association in Long Beach, California, and the first meeting of the review panel on September 18, 2006, in Washington, DC. Those who could not attend one of the open forums were invited to submit written statements.

Those who commented included representatives of professional societies, senior policy professionals and government officials. Their data interests varied, but most were involved in policy, research and program analysis. Of the primary COA areas under review, the submitted comments fell largely into the categories of content development, coverage and output products. Decisions made on COA content and coverage have a direct impact on output products available to COA customers. Realizing these relationships, COA stakeholders expressed their interests in contributing more to questionnaire design and other Census development issues. Written comments provided information on data needs and things that stakeholders would like to see NASS undertake to improve service. The five recurring themes centered on:

- continuing the Agricultural Economics and Landownership Survey (AELOS);
- providing more farm household data;
- enhancing information about government payments;
- reporting on geographic units beyond the county level; and
- improving current data functionality and usefulness.

Stakeholders who testified were highly supportive of the information collected on the AELOS and emphasized the importance of the data within their community. According to them, the AELOS provides a more comprehensive financial picture and the only information on management decisions by non-operator landowners. Comments emphasized that changing patterns in

farmland ownership have increased the number of non-operator farmland owners. Stakeholders envisioned a time when “contractors or operators working on rented land may not be able to provide accurate or complete economic information on farm operations.” This information deficit increases the importance of the AELOS.

Stakeholders noted they would like greater detail in the reporting of household income, including sources of income and wealth from farm and off-farm sources. They also requested that similar household information be collected for non-operator agricultural landowners. Bruce Gardner, University of Maryland, stated that the population census stopped reporting on rural farm households as a separate category in 1990. Gardner also made comparisons between the richness of household data available from Census efforts in the 1960s and the lack of household data currently available.

Stakeholders reported that data on government payments provided by the COA are not sufficient, citing gaps between USDA reported payments and farm receipts payments. The breakout of government payment information, such as conservation payments, is important to COA data users. Stephanie Mercier, Senior Agricultural Economist with the U.S. Senate Agriculture Committee, commented on the importance of tracking the evolution of farm payment composition from the past to the present due to the changing legislative and economic priorities.

Some stakeholders questioned whether county-level aggregations of data are still sufficient. Many programs are implemented at the watershed level, and COA users have commented on the need to report on, and allow for, the aggregation of data along various geographic boundaries.

Stakeholders commented on the current limitations they faced exploiting COA data to its full potential. Customers see a need for NASS to invest in greater capacity to provide linkages between administrative data and COA data and build time-series indicators across multiple Censuses. An additional priority included expanding access to longitudinal files with improved documentation.

Comments also mentioned a perception that NASS is sluggish in responding to changes in ownership patterns and changes in farm sector organization. COA stakeholders recommended that NASS build the capacity to respond to these changes and adjust data collection efforts to capture these changes in agriculture.

Verbal presentations were made by the following stakeholders (in order of presentation):

Bruce Gardner

Distinguished University Professor,
University of Maryland, and Chair,
National Academies of Science Review of ARMS

Mitch Morehart

Senior Agricultural Economist,
Farm Sector Performance and Well-Being Branch, USDA/ERS);
for Susan Offutt (Administrator, USDA/ERS)

Stephanie Mercier

Economist, U.S. Senate Agriculture Committee

Mary Ahearn

Chair, AAEA Economics, Statistics & Information Resources
Committee

Written comments were received from the following stakeholder organizations (in alphabetical order):

American Agricultural Economics Association: Economics,
Statistics and Information Resources Committee;

USDA, Economic Research Service;

Farm Credit Administration;

USDA, Natural Resources Conservation Service;

Rural Sociological Society;

U.S. Senate Agriculture Committee.

**Participants in forum on Review of the COA
at July 2006 AAEA Annual Meeting held in
Long Beach, CA:**

Academic Community

Damona Doye

Oklahoma State University

Jerry Fletcher

West Virginia University

Jeffrey Perloff

University California-Berkeley

Government Agency Community

Bob Bass (USDA/NASS)

David Buland (USDA/NRCS)

Margriet Caswell (USDA/ERS)

Bill Chambers (USDA/FSA)

Mark Harris (USDA/NASS)

Sarah Hoffman (USDA/NASS)

Carrie Litkowski (USDOC/BEA)

Private Sector Community

Mark Jenner (Biomass Rules)



APPENDIX C

Examples of Census Uses and Users

NASS provided the following examples of specific uses and users of COA data that help gauge its value.³⁴

- Congress, especially the agriculture committees, uses COA data when considering farm legislation, such as the farm bills and conservation and farm payment programs. State and county governments use COA data in a similar fashion to the congressional committees, as well as for farmland preservation, rural zoning and tax legislation.
- The Secretary of Agriculture, the USDA Chief Economist's office, as well as most USDA agencies, use COA data in planning USDA programs.
- Food safety agencies at the federal and state and local levels such as the Food and Drug Administration, the Animal and Plant Inspection Service of USDA, the Center for Disease Control and similar state agencies use COA data as a first profile of where a commodity is grown or raised so that when a new disease outbreak occurs, such as in the recent spinach and lettuce cases, they know where to look and, if necessary, where to quarantine or limit distribution.
- Agribusinesses use COA data extensively. Examples include site locations for new ethanol plants, crop storage facilities and transportation hubs.
- The National Council of Farmer Cooperatives uses COA data to identify trends in what its grower members are selling and buying. Many co-ops sell farm inputs to farmers, and the expenditure data are vital to them to anticipate demand and have supplies available.
- The American Feed Industry Association, which sponsors the Annual International Poultry Expo in Atlanta, uses COA data to determine not just numbers and types of poultry at the county level but also the number of growers at the U.S. Postal Service ZIP Code level.
- Members of the American Agricultural Economics Association, primarily agricultural researchers, use, critique and suggest improvements to the COA. Many of AAEA's annual meetings feature presentations of analyses and discussions about topics that feature COA data.
- The National Agri-Marketing Association markets both products to agriculture and agricultural facts. It is media oriented and makes intensive use of COA data to confirm facts and figures that it provides to the public.
- The Food Products Association is a scientific and technical trade association representing the food products industry. FPA held a conference entitled, "Water Shortages in the Food Industry," in October 2006. Census irrigation data, as well as data from the COA's follow-on survey of irrigators entitled, "Farm and Ranch Irrigation Survey," were quoted extensively.
- The American Meat Institute is the nation's oldest meat and poultry trade association. In 2002—in part due to a request from AMI—the COA added for the first time, a question on the on-farm or on-feedlot inventory of cattle on feed.
- The Association of Equipment Manufacturers serves not only agricultural equipment manufacturers but also those who build construction, mining and forestry equipment. They have requested special tabulations from past COAs.
- The American Society of Farm Managers and Rural Appraisers is a group of professionals who provide management, consulting and appraisal services to farm operators and landlords. They are avid users of COA value of land and buildings data. They especially appreciate that such data are available at the county level and would prefer that a Census be taken more often than every five years.
- The National Cattlemen's Beef Association is a heavy user of COA data. More farms report inventory of beef cattle than any other farm commodity. The 2002 COA showed 796,000 farms had beef cow inventory.
- The Bureau of Economic Analysis uses COA results in preparing its national income and product accounts. COA provides the basis for the geographic distribution of BEA estimates.
- When the Farm Service Agency was instructed to monitor the success of its programs in reaching minority farm operators, it asked for a custom COA tabulation. Called RESNOD, it provided detailed counts of race, ethnicity and sex of operators at the county level. The data were used to measure their program's success in meeting compliance requirements of the Farm Bill.



- When USDA's Animal and Plant Health Inspection Service needed population counts of horses on farms to be used in its equine anti-viral program, it called on the COA to provide horse counts from 1850 to the present.
- When a New Jersey advertising firm was attempting to reach farmers and ranchers to market a new livestock pharmaceutical product, it used the COA to determine by county the number of farms with various size cow herds.
- A county planner in Maine used farm counts by size at the ZIP Code level to determine how much a proposed new property tax preference program for farmers might cost his county in lost tax revenues.



APPENDIX D

Examples of Improvements to Recent Censuses

Examples of improvements or changes in the two most recently conducted COAs include:

- Improved planning, beginning with a vision and high expectations, and including detailed work plans, the commitment of full-time staff to the Census, involvement of field offices as full partners from the start, a clear assignment of responsibilities and authorities and full management backing with support and resources.
 - Designed and tested a new “short form” questionnaire that reduces respondent burden on small farmers.
 - Involved a wider range of stakeholders in content review.
 - Completed 2007 COA content testing to allow early finalizing of content and more time for testing the processing system.
 - Introduced an electronic reporting instrument.
 - Improved the list building process, using the Agricultural Identification Survey to update the list of farms and potential farms on an annual basis.
 - Increased the number of area samples to strengthen and evaluate completeness of list frame with special emphasis on coverage of minorities and small farms.
 - For 2007 COA, used consultants early and often to resolve software, database and system design issues.
 - Improved many aspects related to data processing, including a more accurate data-capture system, a faster editing system and more accurate and standardized imputation and coverage adjustment systems.
 - For 2007, developed a multi-phase marketing and information program about the COA to improve public awareness of the COA, stressing the importance of responding and increasing awareness of the available COA products.
 - Incorporated plans for data products and services from the very beginning of the planning cycle.
- Improved methods of assuring that data for farms that cross county and state boundaries are placed consistently.
 - Data for the 1997, 2002 and 2007 COAs are being made more comparable by retrofitting earlier Censuses to be consistent with the most recent COAs.
 - Adopted a census quality-control system for 2002 and improved it for the 2007 planning cycle. The system produces weekly reports and gives a red, yellow or green light relative to data problems, administrative problems, elapsed time, missed deadline issues and processing-system stability.
 - Developed a “data lab” to allow researchers to access COA data for purposes of their own tabulations. Users have to travel to selected sites, be sworn in as a Census agent, be made aware of the severe penalties of illegal disclosure of confidential data and have all products generated by the user examined by NASS for illegal disclosure before data may be taken from the premises. Despite these restrictions, a number of university scientists found the special access to the data to be useful.
 - Began evaluating whether a 6-digit or 4-digit watershed dataset, address-based, can be made to meet publication standards. There is considerable demand for such a product.





APPENDIX E

Biographies of Review Panel Members

James T. Bonnen is Professor Emeritus of Agricultural Economics at Michigan State University. He served as Chairman of the National Academy of Sciences Panel on Statistics for Rural Development Policy in 1979–1980, Director of the President’s Federal Statistical System Reorganization Project in 1978–1980, as a Member of the President’s National Advisory Commission on Rural Poverty in 1966–1967 and as Senior Staff Economist with the President’s Council of Economic Advisors in 1963–1965. In 1981 he received the American Statistical Association’s Washington Statistical Society’s “Julius Shiskin Award for Outstanding Achievement in Economic Statistics.” He is a Fellow and Past President of the American Agricultural Economics Association, a Fellow of the American Statistical Association and a Fellow of the American Association for the Advancement of Science. He has a Ph.D. in economics from Harvard University.

Chet Bowie is Vice President of Market Strategies, Inc.’s Government, Foundation and Academic Research Division. He is a survey statistician and has over 33 years experience designing and conducting cross-sectional and longitudinal household, educational institution and business surveys for the federal and state governments and academic institutions. He has provided senior-level support and managed survey projects across a broad range of substantive areas that include education, employment, health care, health insurance, outdoor recreation, disability, aging, alcohol and drug use, crime, homelessness, housing, program participation, long-term care and income. He has extensive experience conducting methodological research in areas such as interviewing methods, questionnaire design and survey automation and in combining administrative data with survey data for policy-relevant research. Mr. Bowie holds a master’s degree in governmental administration from the George Washington University and is a member of the American Statistical Association (Past Chair of the Government Statistics Section) and the American Association for Public Opinion Research.

Pat Cantwell is an Assistant Division Chief in the Statistical Research Division at the U.S. Census Bureau. He manages research groups in sampling and estimation, disclosure avoidance, time series and small-area estimation. His research has focused primarily on issues in sampling and estimation as applied to household and business surveys, export data, the population census and its post-enumeration survey. He serves as an associate editor of the *Journal of Official Statistics*.

Paul G. Christ is a retired Vice President of Land O’Lakes, Inc. He teaches economics part time in the MBA program at St. Mary’s University of Minnesota and occasionally takes on a foreign assignment for the Land O’Lakes International Development Division. He has foreign experience in Afghanistan, Indonesia, China, Taiwan, Albania, Nigeria, Montenegro, Greece, Macedonia, Bulgaria, the former Soviet Union and Venezuela. Before retiring in June 2000, Paul was responsible for dairy policy analysis at Land O’Lakes and was involved in virtually all of the policy initiatives affecting the dairy industry over his 26-year career. Earlier in Paul’s career, he served as a Supervisory Agricultural Economist for the Dairy Division of USDA’s Agricultural Marketing Service in Washington, DC. Paul received his bachelor’s degree in vocational agriculture and a master’s degree in agricultural economics from Southern Illinois University. He pursued additional graduate study in agricultural economics at Kansas State University.

Damona Doye is Extension Economist and Regents Professor at Oklahoma State University. An Oklahoma native, she joined the faculty at OSU in 1986 upon completing her Ph.D. at Iowa State University. In 1992, she worked in Poland as an Economics Advisor in the Polish/American Extension Project and has had short-term assignments in Poland and Armenia. Damona is the author or co-author of more than 400 publications on farm financial management, record-keeping, leasing, enterprise analysis, cost of production, integrated resource management and management information systems. Her website and materials that teach producers how to use *Quicken* software for farm financial records have been used nationally. She has served as principal investigator (PI) or co-PI on approximately \$2,100,000 of funded projects and participated in an additional \$1,900,000 of funded projects. Damona has supervised the state Intensive Financial Management and Planning Support (IFMAPS) program to provide Oklahoma farm families with one-on-one assistance in business financial planning since 1999.

Jill L. Findeis is Professor of Agricultural, Environmental and Regional Economics & Demography at Pennsylvania State University. She has been on the faculty of the Department of Agricultural Economics & Rural Sociology since 1982. Dr. Findeis is affiliated with the Population Research Institute and the Social Science Research Institute and is a member of the Operations Research Faculty at Penn State. She was recently named a Harbaugh Scholar at Penn State. Her research focuses on agricultural households and particularly labor and income in developed and developing country contexts. She has had a long-term interest in off-farm employment and income as well as farm worker populations and has published edited books on multiple job-holding and farm workers in the U.S. Dr. Findeis is

currently focusing on household decision making, rural livelihoods and regions of rapid land-use transition. Her research has been supported by NIH, OECD, Aspen Institute/Ford Foundation, NRI/USDA, McKnight Foundation, National Endowment for the Arts (farm worker housing), Center for Rural Pennsylvania, Pennsylvania Department of Agriculture, among others.

Jerald J. Fletcher (Vice Chair) is Professor of Agricultural and Resource Economics in the Division of Resource Management and Director of the Natural Resource Analysis Center for the Davis College of Agriculture, Forestry and Consumer Sciences at West Virginia University. He also serves as a Faculty Research Associate with the Regional Research Institute at West Virginia University and an Adjunct Professor with the Department of Economics. Professor Fletcher's research interests include natural resource and environmental economics, energy, quantitative methods, spatial applications in economic analysis and computer applications in applied economic analysis. He has co-authored articles which have appeared in the *American Journal of Agricultural Economics*, *Land Economics*, *Contemporary Policy Issues* and *Transportation Research*. Professor Fletcher received his B.S. in mathematics from the University of Wyoming, an M.A. in economics and a Ph.D. in agricultural economics from the University of California at Davis.

Joe Garrett is Senior Vice President of Market Strategies Inc.'s Government, Foundation and Academic (GFA) Research Division and is responsible for developing the strategic direction of the firm's GFA research, managing the team and growing the practice. During his 30-year career, he has earned a reputation for excellence in directing client-based research in both the public and private sectors. His survey and market research expertise includes sample design, estimation, survey methods and survey operations. He has authored dozens of presentations, papers and articles on survey research techniques and statistical methods, and he is a recipient of Dun & Bradstreet's Customer Focus Award. Prior to joining MSI in 2004, Mr. Garrett served Mathematica Policy Research, Inc., as Vice President and Deputy Director of its Surveys and Information Services Division. Mr. Garrett earned a master's degree in mathematical statistics and a bachelor's degree in mathematics from Miami University of Ohio.

Dawn E. Haines is the Chief Mathematical Statistician in the Office of Research, Evaluation, and Statistics in the Social Security Administration's Office of Policy. She has served in this capacity since February 2005. Prior to joining SSA, Dawn worked at the U.S. Census Bureau as Chief of the Variance Estimation Branch in the Decennial Statistical Studies Division. During her seven years at the Census Bureau, she focused

primarily on census coverage measurement issues and the release of Census 2000 long form data products. Dawn has a Bachelor of Science degree in applied mathematical sciences from Texas A&M University. In addition, she has master's and Ph.D. degrees in statistics from North Carolina State University where her research interests included multiple frame and capture-recapture estimation techniques.

Scott H. Irwin is Professor of Agricultural and Consumer Economics at the University of Illinois. He currently teaches courses on econometrics, commodity price analysis and futures market research. Dr. Irwin's research interests are in the areas of agricultural marketing and price analysis, agricultural risk management, performance of market advisory services, forecast evaluation, commodity market efficiency and behavior of speculators in commodity markets. His research has been published in leading academic journals such as the *American Journal of Agricultural Economics*, *Journal of Financial and Quantitative Analysis* and the *Journal of Futures Markets*. He serves as co-director of the AgMAS project at the University of Illinois, a nationally recognized research and outreach project that provides performance evaluations of agricultural market advisory services. Dr. Irwin also serves as the team leader of the *farmdoc* project at the University of Illinois, an award-winning outreach project that provides comprehensive risk management information and analysis for farmers and agribusinesses in the United States. More than \$4 million in competitive grants have been awarded to Dr. Irwin and his collaborators to support these research and outreach programs. Professor Irwin earned his Bachelor of Science Degree in agricultural business from Iowa State University and continued his education at Purdue University where he earned his M.S. and Ph.D. in agricultural economics.

Daniel Kasprzyk is Managing Director and Vice President for Surveys and Statistics, Mathematica Policy Research, Inc. He is responsible for overseeing the statistical staff and survey research staff in Mathematica's Survey and Information Services Division. He is project director for statistical consultation projects that assist the National Center for Education Statistics, the Energy Information Administration, the Agency for Healthcare Research and Quality and the Internal Revenue Service. Dr. Kasprzyk has over 25 years experience developing and managing large-scale sample surveys and methodological research associated with federal survey programs, including holding various positions on the Survey of Income and Program Participation staff at the Census Bureau and serving as Program Director at the National Center for Education Statistics (NCES), where he was responsible for the Schools and Staffing Survey system. He received his Ph.D. in mathematical statistics from George Washington University.



Paul Lasley is Professor and Chair, Department of Sociology and Chair of the Department of Anthropology at Iowa State University. His research, teaching and extension work focus on farm and rural issues at the state and national levels. He is widely known across Iowa and the nation for his insights and commentaries on the changing face of rural America. His research focuses on the changing structure of agriculture, rural development and community change. He is the author or co-author of over 100 professional journal articles, book chapters and Extension publications. His work has appeared in major national and international media outlets. He received a bachelor's degree in animal husbandry (1974), a master's degree in sociology (1976) and a Ph.D. in rural sociology from the University of Missouri-Columbia (1981).

John E. Lee, Jr. (Review Director) is Professor Emeritus and retired Head, Department of Agricultural Economics, Mississippi State University. Previously, he spent 32 years at USDA's Economic Research Service in Washington, DC, the last thirteen of which he was Administrator of the Agency. His fields of interest and writing are agricultural policy, credit and evolution of the domestic and global food system. John received his undergraduate and M.S. degrees from Auburn University and his Ph.D. in economics from Harvard University. He is a Fellow of the American Agricultural Economics Association.

Virginia M. Lesser is Associate Professor in the Department of Statistics and has been the Director of the Survey Research Center at Oregon State University since 1993. She is responsible for both teaching sampling and survey methods and other applied courses within the Department of Statistics at Oregon State University. Since 1993, Dr. Lesser has been responsible for directing over 150 major survey projects through the Survey Research Center. While conducting these Survey Research Center surveys, Dr. Lesser has collaborated with staff from a range of Oregon State Agencies including the Oregon Department of Fish and Wildlife, Oregon State Marine Board, Oregon Sea Grant, Oregon State Parks and Recreation, Oregon Agricultural Extension Service, Hatfield Marine Science Center and the Oregon Agricultural Experiment Station. She received her M.S. degree in statistics from North Carolina State University and a Doctorate in public health in biostatistics from the University of North Carolina at Chapel Hill.

Joe Molnar is Professor of Rural Sociology in the Department of Agricultural Economics and Rural Sociology at Auburn University. His research interests include Sociology of Agriculture, Research Methods and Statistics, Technology Transfer, Rural Development, Environmental Sociology, Social Organization and Interorganizational Relations. Professor

Molnar received his B.A. and M.A. in sociology from Kent State University and his Ph.D. in sociology from Iowa State University.

A. Gene Nelson (Chair) is Executive Associate Dean of the College of Agriculture and Life Sciences at Texas A&M University. In this position, he has responsibilities for academic, student and faculty programs. He received his education at Western Illinois University and Purdue University and joined the faculty at Oregon State University as Assistant Professor and Extension Farm Management Specialist in April 1969. In 1981, he was named Head of the Department of Agricultural and Resource Economics. In 1990, he moved to Texas A&M University, where he served as Department Head until January 2005. Dr. Nelson's research and Extension programs have emphasized risk analysis in farm decision making. He received the USDA Superior Service Award for leadership in developing innovative risk management teaching materials. He has authored several publications including an undergraduate farm management textbook.

Lynne Stokes is Professor of Statistical Science at Southern Methodist University in Dallas, Texas. She has a Ph.D. in statistics from the University of North Carolina at Chapel Hill. She was a mathematical statistician in the Center for Social Science Research at the U.S. Bureau of the Census from 1981–83. Her research interests are sampling methods, modeling of non-sampling errors in surveys and disclosure limitation methods. She has authored or co-authored over 40 refereed papers and book chapters. Her research has been supported by the Institute for Educational Sciences, U.S. Environmental Protection Agency, U.S. Bureau of the Census, U.S. Department of Health and Human Services, Dell Computer, IBM Computer and Tivoli Systems. Dr. Stokes has served on a National Academy of Sciences Panel on Alternative Census Methodologies and Panel on Recreational Fisheries Survey Methods. She is a past editor of *The American Statistician* and has served on the editorial board of the *Journal of Official Statistics*, *Survey Methodology* and *Journal of the American Statistical Association*.

Alton Thompson is Dean and Executive Director for Agricultural Programs in the School of Agriculture and Environmental Sciences at North Carolina A&T State University. Dr. Thompson's academic specialty is in the interface of statistics, research methods, demography and rural sociology. In 1985, he was selected as a Visiting Scholar at the United States Department of Agriculture's Economic Research Service; and in 1988, he was selected as the Martin L. King-Rosa Parks Visiting Scholar at Michigan State University. His research has resulted in the publication of 25 articles in refereed journals, seven book chapters and a book entitled



Quality of Life Among Rural Residents in North Carolina: Community and Life Satisfaction. His research focus includes agro-medicine, rural poverty/development, labor economics and structure of agriculture. Dr. Thompson's grantsmanship has resulted in more than \$2,500,000 in extra-mural research funds for the School of Agriculture and Environmental Sciences. He received his B.S. degree at North Carolina Central University and his M.S. and Ph.D. at The Ohio State University.

Carl Zulauf is the Francis B. McCormick Professor of Agricultural Marketing and Policy at The Ohio State University. He has teaching responsibilities for introductory economics, managerial economics and futures and options markets. His research is focused on agricultural policy and agricultural futures and options markets. During 1985, Dr. Zulauf was on leave with Senator John Glenn's Washington, DC office, assisting with food and agricultural legislation. During the summer of 1993, he was program director for Ohio State's study abroad program in the Czech Republic. During the spring of 2001, he served as program director for Ohio State's study abroad program in China and Taiwan. Professor Zulauf received his B.S. and M.S. from The Ohio State University in agricultural economics and his Ph.D. from the Food Research Institute, Stanford University. Dr. Zulauf has received numerous awards for teaching and has authored or co-authored 53 journal articles and 178 other articles.





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