



Brazilian Master Frame for Agricultural Statistics

Flavio Bolliger

IBGE, Rio de Janeiro, Brasil – flavio.bolliger@ibge.gov.br

Andrea Diniz da Silva

IBGE, Rio de Janeiro, Brasil – andrea.silva@ibge.gov.br

Abstract

The National Statistics Offices have been experiencing an increasing demand for more and better statistics. Especially in agriculture domain, users request broader, high quality and more up-to-date information. To meet such demand, the Brazilian Institute of Geography and Statistics (IBGE) is working to implement a National Agricultural Survey System (SNPA). A master frame is an important part of SNPA and its development is on the way. This paper presents the project and the contemporary developments towards creation of the Master Frame for Agricultural Statistics, highlighting main issues on alternatives for structuring the master frame, use of administrative data, difficulties inherent to data integration and regarding the accuracy of the estimates.

Keywords: sampling frame; agricultural survey; master frame.

1. Introduction

Experienced statisticians often say that there are two elements that are paramount to the success of a statistical survey, the two things for which one should drive the most care and concern, without which all the quality that can be obtained for the other elements of a survey may not ensure minimum quality of the results. These two elements are the master frame and fieldwork. In other words, the success and quality of a survey depends crucially on the quality of the master frame on which it is based. So, to paraphrase Archimedes, a statistician would say: "give me a master frame and I will reveal the world". However, to build and maintain a quality master frame is perhaps the most challenging task in keeping on survey system.

The National Statistics Offices have been experiencing an increasing demand for more and better statistics. Especially in agriculture domain, users request broader, high quality and more up-to-date information. It means that the Census Program, whose occurrence is too spaced in time, cannot meet part of the demand. On the other hand, traditional subjective surveys, although they may provide adequate frequency, depend on indirect information and thus have very limited scope. Meet the current demand requires direct inquiries to the producer. Do it with required frequency and quality depends on setting up a survey system and therefore a master frame.

For no other reason that is the heart of the Global Strategy (GS). The GS advocates for an agricultural survey system based on a single master frame to guarantee complete integration and consistency of the estimates.

The Brazilian Institute of Geography and Statistics (IBGE) has been planning the implementation of its new national agricultural survey system during almost a decade. This is a big survey system and even for a big institution like IBGE it was not yet possible to implement it mainly due to institutional operating capacity reasons in face of other priorities. Besides, the creation of a master sampling frame still remains an issue, from a technical point of view, has been an additional factor in the postponement of the project implementation.

2. National Agricultural Survey System

A system of agricultural surveys keeps being an important aspiration to the improvement of Brazilian agricultural statistics. The National Agricultural Survey System (SNPA) project is being developed under the responsibility of the Coordination of Agriculture of IBGE. Its main objectives are to build a master sampling frame and produce continuous agricultural statistics with higher quality (improving accuracy and error measure), based on individual data collected using probabilistic sample surveys. Considering previous experiences, it foresees being implemented on the entire national territory.

Its main survey, the annual Agriculture Activity National Survey (PNAG), was planned as a multipurpose and continuous survey, covering various aspects of social, economic and environmental issues, including the following objectives: investigating annually the agricultural activity; producing basic statistics for the sector, determining the economic performance and financial status of the agricultural units, main activities, production systems and types of establishments, annually; investigating the structural, socioeconomic, technological and environmental aspects of the agricultural sector, periodically; providing a database for research and analysis of the agricultural and rural development policy, ensuring longitudinal analysis. The SNPA project includes also a conjunctural survey (Quarterly Production Survey (PNPA)) to collect quarterly data on agricultural production. The System is based on a single master sampling frame as recommended by the Global Strategy.

3. Master Sampling Frame

The design of a master sampling frame for the SNPA, including a list frame and area frame, was planned to come together through the traditional approach, using the Enumeration Areas (EA) and the information of the Agricultural Census. Instead of using segments like selection units, the model has as its Primary Sampling Unit the EA (or a group of contiguous EAs) and selects, in a second stage, directly the agricultural establishment.

The deterioration and the mechanism for its updating the master sampling frame is an issue that remains open once Brazil can keep on being a country of important dynamism regarding land use. It's easy to say that a sample from a master frame based on the 1996 Agriculture Census master would be under dimensioned regarding the agricultural activity in the States of Mato Grosso, Maranhão, Piauí and West of Bahia. It would not properly reflect the dislocation of the livestock to the north of the country and even the substitution of pastures and other cultures by the sugar cane, in a State of secular agricultural occupation, as São Paulo, just to quote some of the most evident movements.

The discrepancy of the last census data (2006) was one of the main reasons to not have started the SNPA in 2013 and have postponed it to be conducted alongside with the next XI Brazilian Agricultural Census, planned to 2016. However, the uncertainty about the date of the next Brazilian Agricultural Census, as the necessary budget was not included in the Annual Budget Law, the Coordination of Agriculture initiated studies on the methodological alternative for the SNPA, in particular, regarding the master sampling frame for agricultural surveys.

One of the alternatives considered is quite radical, and lies on the advancements observed in the country's administrative registers. In this alternative, the target population of SNPA would be redefined, becoming the set of units of the agricultural establishments under the domain of the formally registered, by the Federal or State Government, agricultural producers. In this case, the target population is more restricted than the one registered in the Agricultural Census. Ceases to include agricultural establishment whose primary function is leisure, housing or livelihood, or producers that have agriculture as a secondary activity for which the holders neither recourse to the government for funding or technical assistance nor engaged in marketing of products to the point of seeking to observe the provisions of movement of goods. The relevance of these constraints is minimized by the current scope of our administrative records, in particular, the National Programme of Family Agriculture (PRONAF) register that is driven to family farms and now has almost 5 million active records.

The SNPA's sampling frame would be constituted by a list of rural producers, built from lists of establishments provided by the Federal and State Governments, updated periodically. Such approach would present the following advantages, disadvantages and risks:

Advantages

- The Reference system's Annual updating;
- Independence regarding sector weave;
- Independence from the Agricultural Census; and
- Low implementation cost.

Disadvantages

- More restrict target population;
- Does not meet the integration with the Agricultural Census; and
- Bigger dependence on the quality of external registers.

Risks

- Difficulty of access to the external registers;
- Alteration and discontinuity of external registers.

Another possibility is to use information from the new project of Land Use and Coverage, developed by IBGE's Geosciences Directorate. The project's main goal is to monitor the changes in use and coverage of land for the entire national territory every other year, using Moderate Resolution Imaging Spectroradiometer (MODIS) images. In the Project, the following categories and classes of land use and coverage are mapped: anthropogenic non-agricultural areas; anthropogenic agricultural areas (agricultural area, planted pasture, agricultural area with mosaic and forestry); forest vegetation areas (forest vegetation and mosaics of forest vegetation and agricultural activity); rural vegetation areas; water and sparsely or not vegetated open spaces

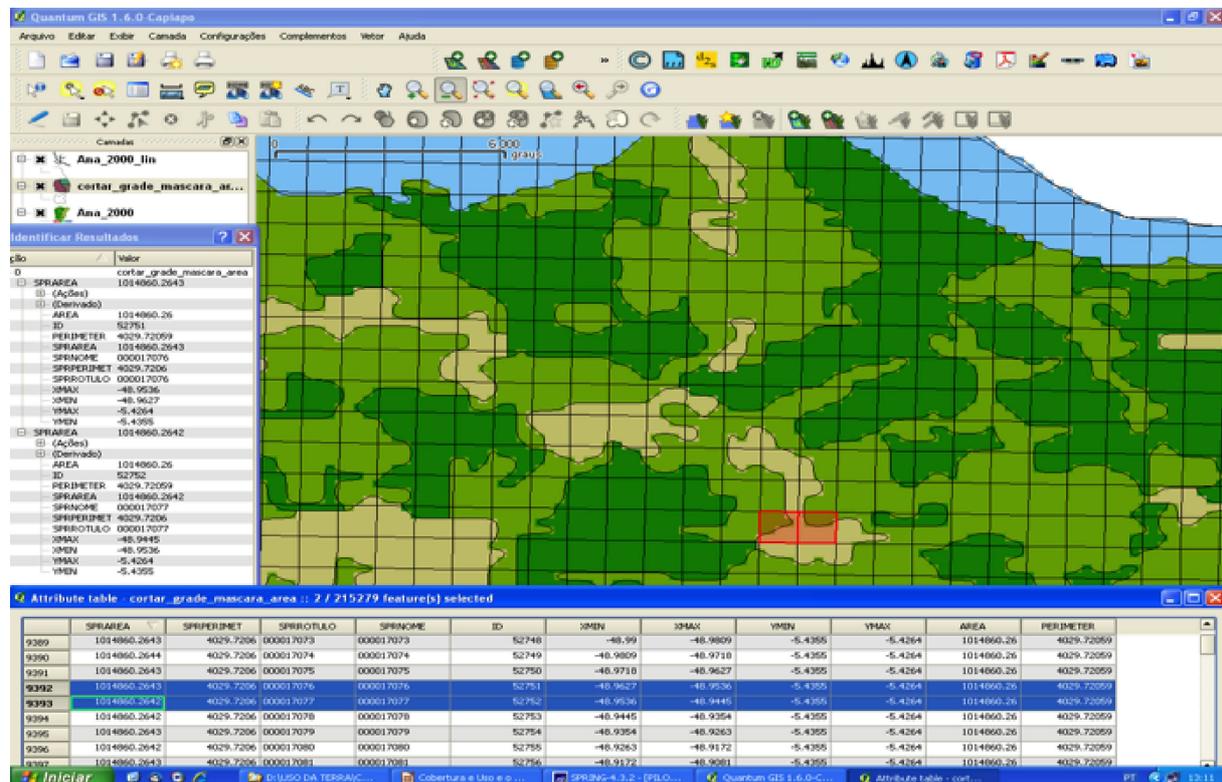
Such information is provided through a territorial grid for statistical purpose. For its construction, the Albers equal-area conic projection was used, in order to guarantee equally sized squares. The official set of grids holds the following levels:

Nome	Dimensão (km)	Código	Área (Km2)	Número de células
GRE500KM	500	2556	250.000	56
GRE250KM	250	2456	62.500	181
GRE100KM	100	2555	10.000	960
GRE50KM	50	2455	2.500	3076
GRE25KM	25	2355	625	14.395
GRE10KM	10	2454	100	88.356
GRE5KM	5	2354	25	351.802
GRE1KM	1	2353	1	8.861.508
GRE500M*	0,5	2253	0,25	35.446.032
GRE250M*	0,25	2153	0,0625	141.784.128
GRE100M*	0,1	2252	0,01	886.150.800

* Ainda não implementadas

Picture 1 shows the incorporation of use and coverage data in the territorial grid for statistical purpose, in which is possible to recover area data on the categories of land use and coverage for each square

Picture 1: Mapping and land use and coverage incorporated to the territorial grid for statistical purpose



The utilization of an area frame based on such information, stratifying and selecting squares, requires the use of mobile devices and GPS for field limits identification, and presents the following advantages and disadvantages:

Advantages

- Defines segments with the same size
- Permits the selection of segments that are multiples of 1x1 Km
- Biannual update
- Does not rely on census data

Disadvantages

- No visually identifiable boundaries
- Larger variability of the number of establishments in each segment
- Based on less accurate information than the provided by the Census

4. Discussion

The use of both alternatives presented requires a scope study to evaluate feasibility and efficiency of each one. It has, however, as its central aspect, issues regarding the definition of the most appropriate agricultural master sampling frame.

Adopting an area frame is always mentioned as a good strategy once, by construction, it is a complete register, which include exhaustively and without erroneous inclusions, of the entire target population of the survey. However, it is necessary to take into account that such characteristic is regarding only to the primary sampling units (enumeration area or a set of contiguous enumeration areas). The quality of estimates will still depend on the proper identification and listing of the ultimate sampling units (SSU) such as the agricultural holdings. In countries or regions where the small establishments are clearly identifiable it may not pose a significant problem. However, in Brazil, where there are important agricultural regions with large areas covered by, for example, sugar cane, soy or corn, with no people living in and no clear identification of boundaries between farms, identifying the establishments can be significantly difficult.

In addition, some important segments of agriculture are developed by a small number of geographically dispersed establishments, for instance poultry and pigs. In such cases to obtain reasonable precision for the estimates based on area frame would require a big sample size. For similar reason, the selection of large establishments is usually made from a list.

To balance the strengths and weakness of both approaches can be a reason to combine area and list frames and have the National Agricultural Survey System based on a double frame.

References

BOLLIGER F., FREITAS M. P. S., ANTONACI G. A. and CABRAL M. D. B. Master Sampling Frames for Agricultural Surveys: Brazil overview. High Level Stakeholders Meeting on the Global Strategy: From Plan to Action. Expert Session: Master Sampling Frames for Agricultural and Rural Statistics. Rome, 3- 5 December 2012.

GUEDES, C. A. B., PERRUSO, J. C. and LAURIA, C. A. Pesquisas Agropecuárias por Amostragem Probabilística no IBGE: histórico e perspectivas futuras. Texto para Discussão número 25, Rio de Janeiro, Instituto Brasileiro de Geografia e Estatística. 2007.

FREITAS M., LILA, M., SANTOS, Vera et al. Brazilian Agricultural Survey System - a description of sampling methods. Sixth International Conference on Agricultural Statistics (ICAS VI), Technical Session 2.3: SPP 2 - Survey Design and Sampling Strategies for Agricultural Surveys. Rio de Janeiro. 23-25 October 2013.

Proposta de Sistema Nacional de Pesquisas por Amostragem de Estabelecimentos Agropecuários – SNPA: concepção geral e conteúdo temático. Rio de Janeiro: IBGE/Diretoria de Pesquisas/Coordenação de Agropecuária. 2011. Available at: http://www.ibge.gov.br/home/estatistica/indicadores/prpa/SNPA_concepcao_e_conteudo2av.pdf Access: Set 2013.

WORLD BANK (2010). Global Strategy to Improve Agricultural and Rural Statistics. Report Number 56719-GLB. Washington, DC: World Bank, September 2010. 55p. Available at: http://www.icas-v.org/AgStat_GlobalStrategy_10.pdf. Access: Nov 2010.