

# Gathering spatial data on social vulnerability in Brazil

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## Abstract

The Brazilian Ministry of Agricultural and Social Development coordinates several public policies aimed at minimizing social vulnerabilities by means of several programs. These programs' databases are broadcasted to dedicated teams that manage their data using spreadsheets. The need for an integrated view on the territorial coverage of these data motivated a partnership with Embrapa. This paper aims to present the main results of the quantitative, qualitative and cartographic analyses on this data. The resulting geographic data are available in a web platform that may be used in the decision-making process for the expansion or reorganization of governmental social programs.

## 1 Introduction

The Brazilian Ministry of Agriculture and Social Development (Ministério do Desenvolvimento Social e Agrário, MDSA) is responsible for the guidelines on public policies that handle social inequalities and vulnerabilities. It is equipped with a large database that manages thousands of records and information on several social programs and on the citizens assisted by each of them. Each social program is supervised by dedicated teams which deeply understand the singularities of their actions. However, MDSA currently does not have mechanisms to provide an integrated view on the territorial coverage of its actions and on the correlations between its several social programs.

In order to fulfill this need, MDSA celebrated an agreement with the Brazilian Agricultural Research Corporation (Empresa Brasileira de Pesquisa Agropecuária, Embrapa) for the latter to spatialize these programs' database and correlate them. Embrapa produced quantitative, qualitative and cartographic analyses about the Brazilian cities and the families assisted by the programs.

The aim of this work was to organize and correlate data on MDSA's social programs for strategic territorial analyses, considering two main purposes: to overlap data among different social programs and to enable cartographic analyses by means of a spatial view of the data. Embrapa also detected the need and developed a web platform to host the spatial data and to enable the users to perform queries on it.

Territorially overlapping the data on these programs provides information to support decision making in terms of the distribution of financial resources, the strengthening and/or reorganizing of the assistance to cities and families in need, and improves and optimizes the performance and action range of the governmental agencies.

## 2 Material and Methods

### 2.1 Database Organization

The original data were spatialized on the city level. Social programs were analyzed in terms of the number of families assisted and on spatial coverage and were correlated with other programs based on the assisted cities. Cartographic analyses were performed to detect the presence or the absence of social programs in Brazilian cities. Data on the following social programs were used:

- Water-tanks program: Benefits people with limited access to water with the construction of water tanks that capture and store water for use in households, schools or farms;
- Distribution of 'food parcels': Benefits people living under scarcity and vulnerability by means of the distribution of staple food parcels;

- Food security map: Maps the families included in the Single Registry for Social Programs of the Brazilian Federal Government and among which food and nutritional insecurity still persists, considering as main variables (indicators) chronic and acute malnutrition (height-for-age and weight-for-age deficits, respectively) of children under 5 years old along with families assisted by an allowance program;
- Program to foster farming activities: Benefits small farmers by fostering their productive inclusion through financial resources for investments;
- Food Acquisition Program: Small farmers are benefited as preferential suppliers by public entities that buy the food from family farms;
- Seed Warehouse Program: The program is based on the construction of community seed warehouses in the semiarid region, and aims to benefit family farmers that are part of the Federal Government's Single Registry for Social Programs.

Processing and preparing the data for each social program required an amount of effort in order to adapt, correct, convert and make the data compatible for the spatialization process. Data were filtered to identify gaps, duplications, typos, registration errors and differences in spatial location (conflicting information on city and state, for example).

## 2.2 Spatialization Process

Based on the revised database, the data about each social program were spatialized using the official Brazilian city borders. Layouts containing different themes and territories (region, state, city) and featuring results in the form of aggregated percentages and accumulated totals were produced for each social program in geographic information systems (GIS).

## 2.3 Web Interface - WebGIS

The spatial data produced was made available through a web interface, named WebGIS. The technology platform that supports the WebGIS relies on open source tools and libraries. The management of the vector spatial data published on the web interface adopts the database management system PostgreSQL<sup>1</sup> and its extension PostGIS, which adds support for geographic objects and operators. The data stored became available via web protocols through geographic web services, according to OGC (Open Geospatial Consortium) standards, using WMS (Web Mapping Service), WCS (Web Coverage Service) and WFS (Web Feature Service) services. We adopted the GeoServer (geoserver.org) map server to provide this functionality. The WebGIS interface was built using javascript Openlayers, ExtJS, Geoext and GXP libraries<sup>2</sup>, which are capable of consuming geographic web services, rendering geographic data over maps and providing a range of visual components for user interaction.

## 3 Results

For each social program, we produced technical reports and maps on a national and state scale, plus the Federal District. The analysis of the spatial coverage of the social programs shows that 57% of the Brazilian cities that show some degree of food insecurity are registered in at least one social program (3,183 cities show a very high, high or average degree, and there is a total of about 1,3 million families in urban and rural areas).

Food parcels were distributed in 1,507 Brazilian cities (27%) and benefited 276,156 families. The program to foster farming activities assisted 215,844 families in 2,055 cities (37%). The water-tanks program built more than 900 thousand structures – 789,635 (82%) for households, 165,461 (17%) for agricultural and animal use, and 3,519 (less than 1%) in schools at rural areas –, and it is available in 1,446 cities (26%) located mainly in the semiarid region, which is traditionally affected by drought periods.

A number of 33,876 families sold their production in the food acquisition program (44,383 tons of food in 2016). The milk supply chain alone exceeded 33 million reais in marketed value, and around 13,430 families in 403 cities are part of these numbers. The seed warehouse program helped about 12 thousand families in 207 cities at the semiarid. Bean is the crop most planted by small farmers, which

<sup>1</sup> [postgresql.org](http://postgresql.org) | [postgis.net](http://postgis.net)

<sup>2</sup> [openlayers.org](http://openlayers.org) | [docs.sencha.com/extjs](http://docs.sencha.com/extjs) | [www.geoext.org](http://www.geoext.org) | [github.com/boundlessgeo/gxp](http://github.com/boundlessgeo/gxp)

shows its importance for food security.

As an example of the correlation of programs, the overlap analysis of the spatial data on food security and food parcels shows that 122 cities under food insecurity were not assisted by food parcels. The original database and the spatial data analysis results are available in a web interface for use by the MDSA team (Figure 1). As soon as the system is validated by their technical teams, it will be available for public use.

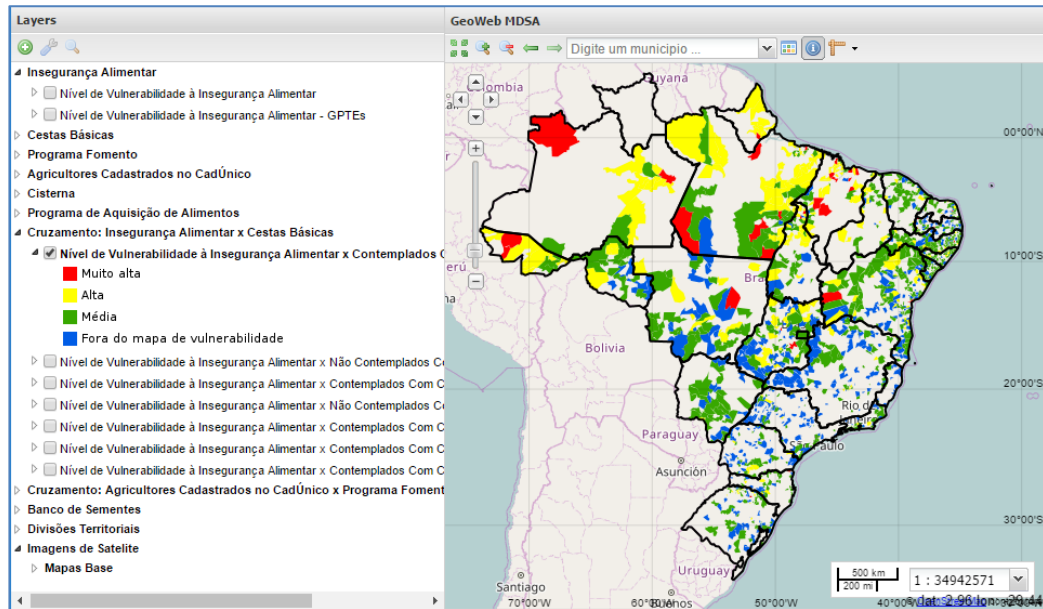


Figure 1 – GeoWeb interface.

## 4 Conclusions

Brazilian social programs minimize urgent demands, and in many cases promote conditions of self-sufficiency to the affected population. Geoprocessing techniques help map social vulnerabilities and provide spatial knowledge on territory needs and on the coverage of social programs. This spatial perspective helps public managers in the decision-making process in Brazilian cities, based on assertive public policies. The results contribute to identifying priority regions for public actions, by revealing territorial gaps which demand more attention by the public managers. The results provided by the GeoWeb platform allow users with all levels of experience to query and get to know the reality of each Brazilian city assisted by the MDSA.

## 5 References

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