IBGE
Instituto Brasileiro de Geografia e Estatística

censo 2010

Reunión del Comité Ejecutivo de la

Conferencia Estadística de las Américas de la CEPAL

The 2010 Brazilian Population Census: Quality Control System for Collection, Supervision and Data Processing

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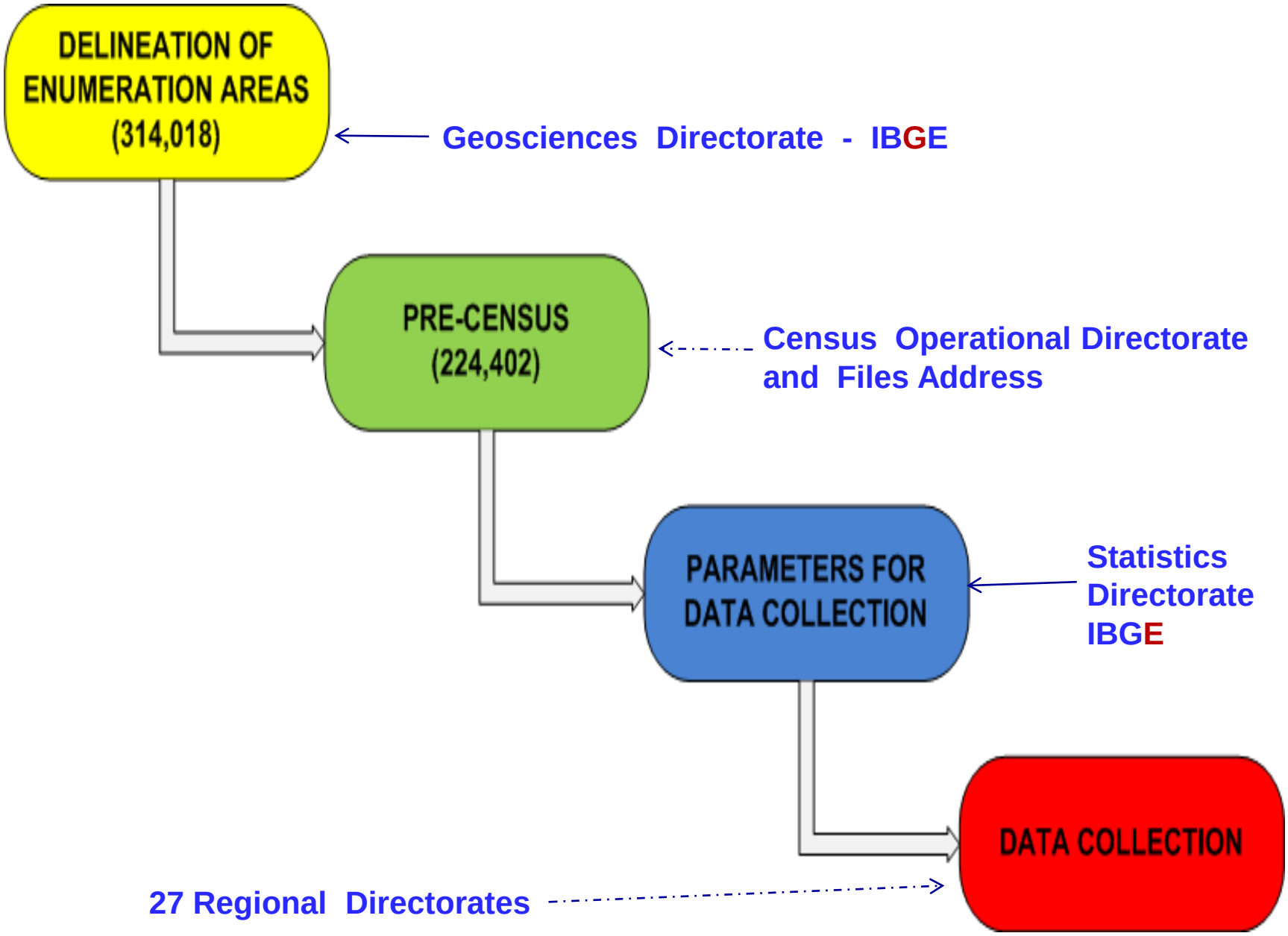
Havana, Cuba, 7th April, 2011

2010 Population Census

- **Brazilian Population Census produces information on the characteristics of people and households for each municipality**
- **Population Census is the main challenge for a Statistical Office, specially in a country like Brazil, with 8,514,876 km² distributed in an heterogeneous and sometimes inaccessible territory**
  - 27 Federation Units
  - 5,565 Municipalities
  - 318,000 enumerators area
  - 7,000 local offices
  - 32,000 supervisors and 190,00 enumerators
  - 67,491,720 million housing units
  - 190,732,694 inhabitants

2010 Population Census – Planning of main steps



Delineation of 314,018 Enumeration Areas (EA)

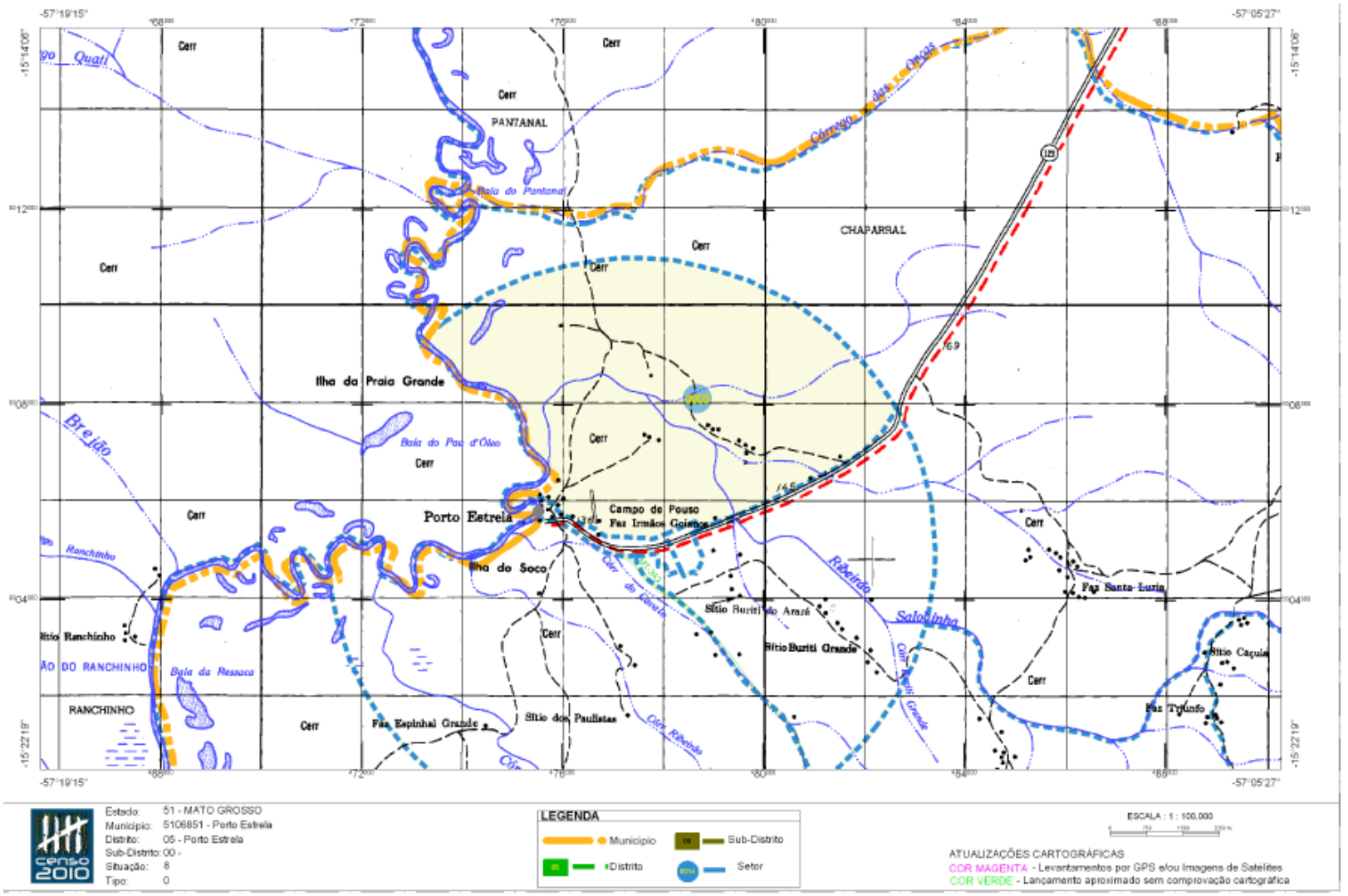
- **For 2010 Census, IBGE developed a Census Mapping Project to integrate Municipalities' urban and rural areas and built a full digital format, starting by using technology of satelite imagery**
- **All 314,018 enumerator areas had a cartography geocoding**
- **Characteristics of 2010 Census Enumeration Areas**
  - Each enumerator area is a **continuous area** located at rural or urban places
  - Regards legal limits of boundaries of each municipality, districts and sub-districts
  - Urban EA: covers 300 / 350 housing units
  - Rural EA: covers 150 agricultural holdings (maximum 500 km^2)

Delineation of 314,018 Enumeration Areas (EA)

Enumeration Areas: Urban

Delineation of 314,018 Enumeration Areas (EA)

Enumeration Areas: Rural



2010 Census Mapping

- **Building of an integrated Territorial Database to support 2010 Census, from the planning to the collection and dissemination steps:**
  - Associate the “National Address File for Statistical Purposes – CNEFE” file to the blocks and block-face urban enumeration areas;
  - Geometrical adjustment of urban and rural limits for each Municipality
- **SISMAP – Brazilian System for Census Mapping**
  - IT tool developed for municipal mapping in a single continuous spatial database;
  - Input data from several sources of vector and imagery data, like GIS, GPS, satellite imagery, digital and aerial photography

Evolution of Geo-Technologies

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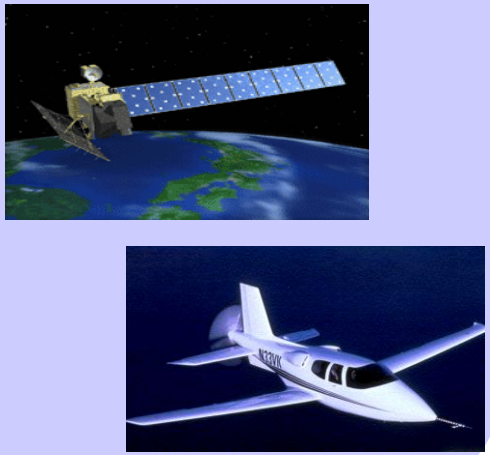
Handheld Devices (PDA)

GIS/Web

Low Cost Images



Growing Application at IBGE for both Cartography and Statistics

Brazilian Geospatial Statistics

Pre-Census in 224,402 Enumeration Areas (EA)

IBGE

Pre-Census (from March to June 2010)

- **Review of urban Enumeration Areas performed by 32,000 supervisors hired for the Census:**
  - Loading enumeration area maps and the list of streets and block-faces associated with the map
  - Review / updating digital maps with PDA
  - Review / updating association of addresses to digital maps
  - Work unit: block-face

Duties of Supervisors for Quality Control:

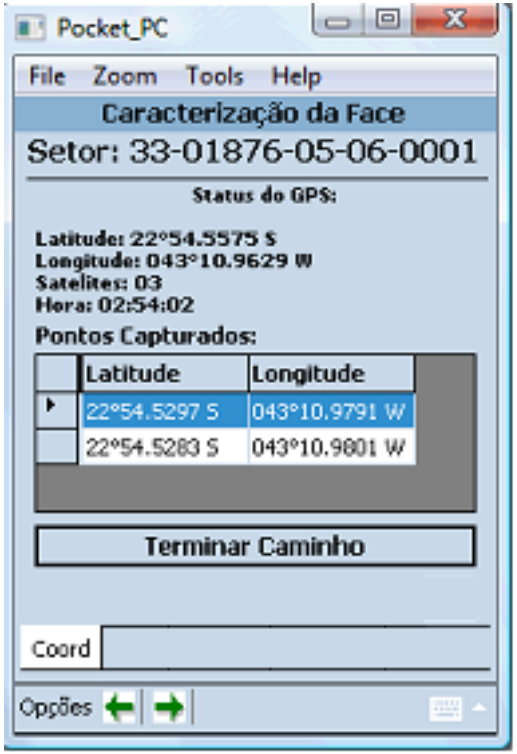
- For each street: confirm, delete, include, change the name and/or change name's orthography
- For each block-face: include, exclude, confirm or classify as "NAR" (no addresses in the block-face) and collect surrounding characteristics (electricity, sanitation, security, etc.)
- Tracking with GPS the shape of block-faces not represented on the previous mapping

Pre-Census Application: 1st use of PDA

- **Personal Digital Assistant (PDA) application:**
  - The application was developed in Windows Mobile, using SQLServer CE 2005, Framework 2.0 and Geopad
  - Loaded in 30,000 PDAs

Pre-Census Application

- **PDA application:**
  - Some forms to collect data:



Parameters for Census Data Collection

IBGE

- Based on information of the Enumeration Areas and data collected during Pre-Census, some parameters were created by Directorate of Statistics to control quality of data collected by the enumerators during the Census;
- These parameters were loaded into control and monitoring IT System of data collection, being used by supervisors to assess the work of Census enumerators, in each 7,000 Local Offices;
- Address list raised by Pre-Census was used by 23,000 supervisors to route control work of 190,000 enumerators and for coverage control;
- Data Quality was controlled for each Enumeration Area, calculating type of housing units rates, average number of persons per housing unit, sex rates, age, etc.

Census Data Collection

- **Questionnaires**
  - All **56.5 million** of **occupied housing units** were surveyed to collect characteristics of the dwellings and living people.
  - IBGE used two models of questionnaires:
    1. **short form**, with 24 questions for housing unit and 13 for people;
    2. **long form** (**sample**) with 38 questions for housing unit and 69 for people (including same questions of the short form).
  - The choice of questionnaire was done by **random selection** in the PDA during the Census time.
  - The average sampling rate is 11%. The rates depend on the number of inhabitants of the municipality and varies from 5% (more then 500,000) to 50% (less then 2,500 inhabitants).
  - **190,000 PDAs were used by enumerators to collect data**
  - **Data confidentiality –** enumerators do not unlawfully download the information from the PDA. After ending an interview, data are encrypted and can only be transferred to the IBGE through a secure network.

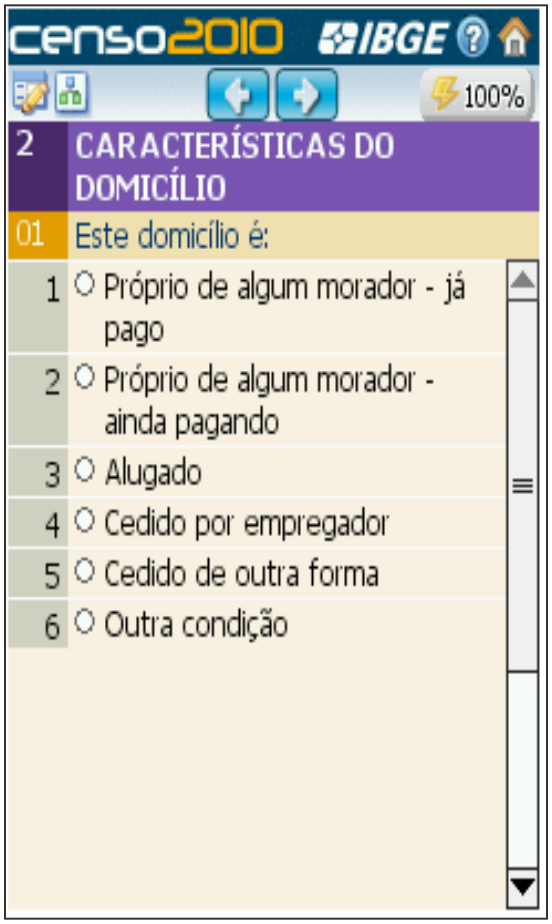
Data Collection Local Software Applications

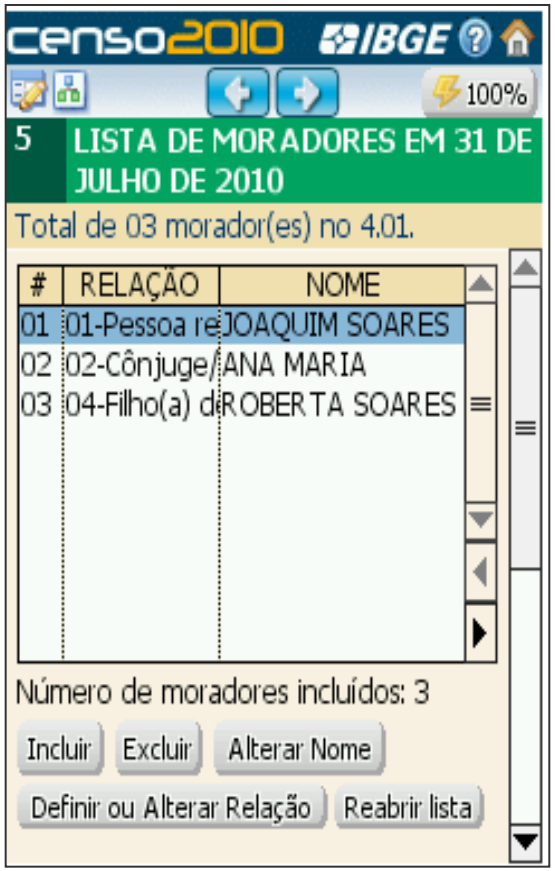
- **Data collection:**
  - Running on the PDA in order to record the presential interviews, identify the households answering by Internet (token) and update the Address List.
- **Data collection / Internet**
  - WEB application to fill out the forms by the households.
- **Supervision:**
  - Running on the PDA to evaluate and control the enumerators work quality during the interview.

- **SIGPC - Management system for Data Collection Station**
  - Running on the notebook supports for all decentralized operations, supported administrative and operational tasks and the communication with the Central System

Data Collection Questionnaires Application

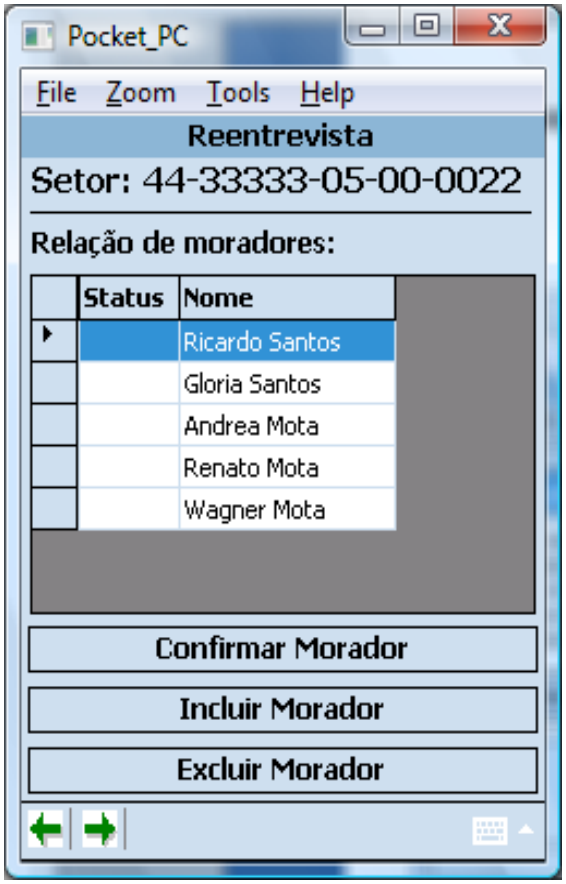
System developed in Windows Mobile and TotalCross

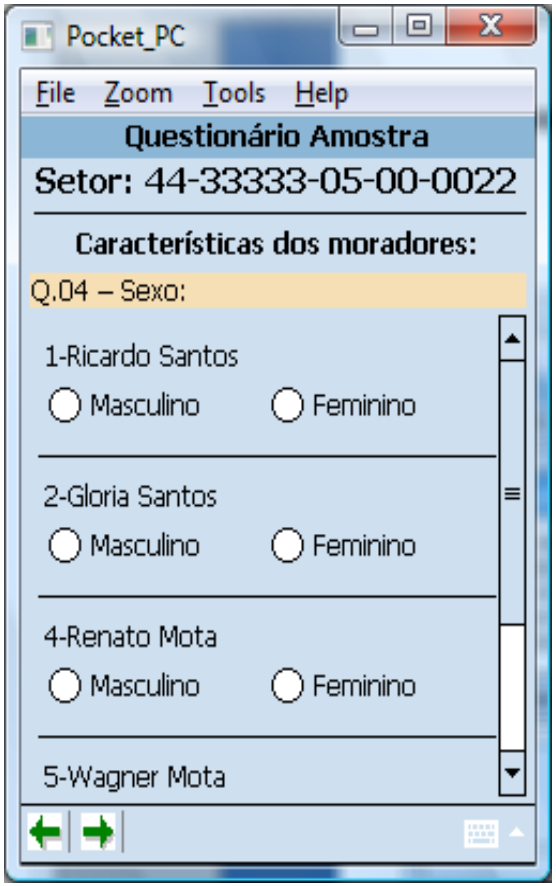




Data Collection Supervision Application

- **Developed in Windows Mobile, SQLServer CE 2005, Framework 2.0, Geopad**
- **Management Indicators and results of the previous visits**





Data Collection Local Control Application

SIGC - Data Collection Management Indicators System
Monitoring evolution of data collection (coverage, quality and time of collecting) in each Enumerator Area.

- **Local application in Data Collection Station (Local Office) running at notebooks under Windows 7.**
- **SIGC system is essential tool for the administrative and operational organization and quality control of data collection:**
  - with registration of temporary work force
  - task association to staff
  - loading the application and Enumeration Area data into PDA
  - receive collected data from the PDA
  - communications with Central Datacenter
  - reports for quantitative and qualitative evaluation of data collected

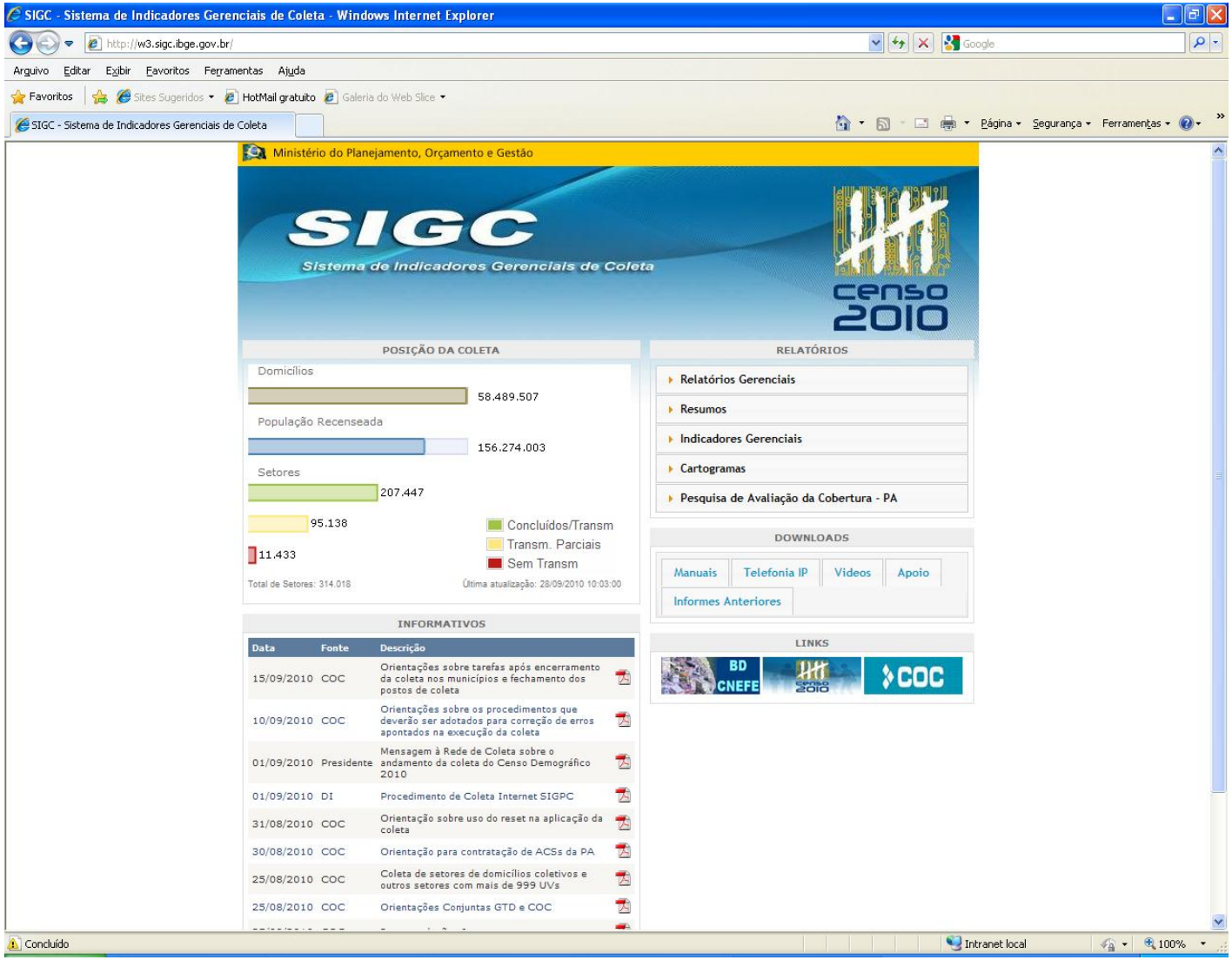
Data Collection Central Software Applications

- **SIGC - Data Collection Management Indicators System**
  - Monitoring evolution of data collection (coverage, quality and time of collecting in each Enumerator Area).
  - WEB application running in the main Datacenter support management reports, summaries, indicators and cartograms
- **Database system**
  - Specialized data model to store the summaries of the data collection, data of supervision, administrative data and List of Address File data.

- **Control of Data Collection**
  - Twice a day, Directors received a Summary of Census Progress Report.

Data Collection Central Control Application

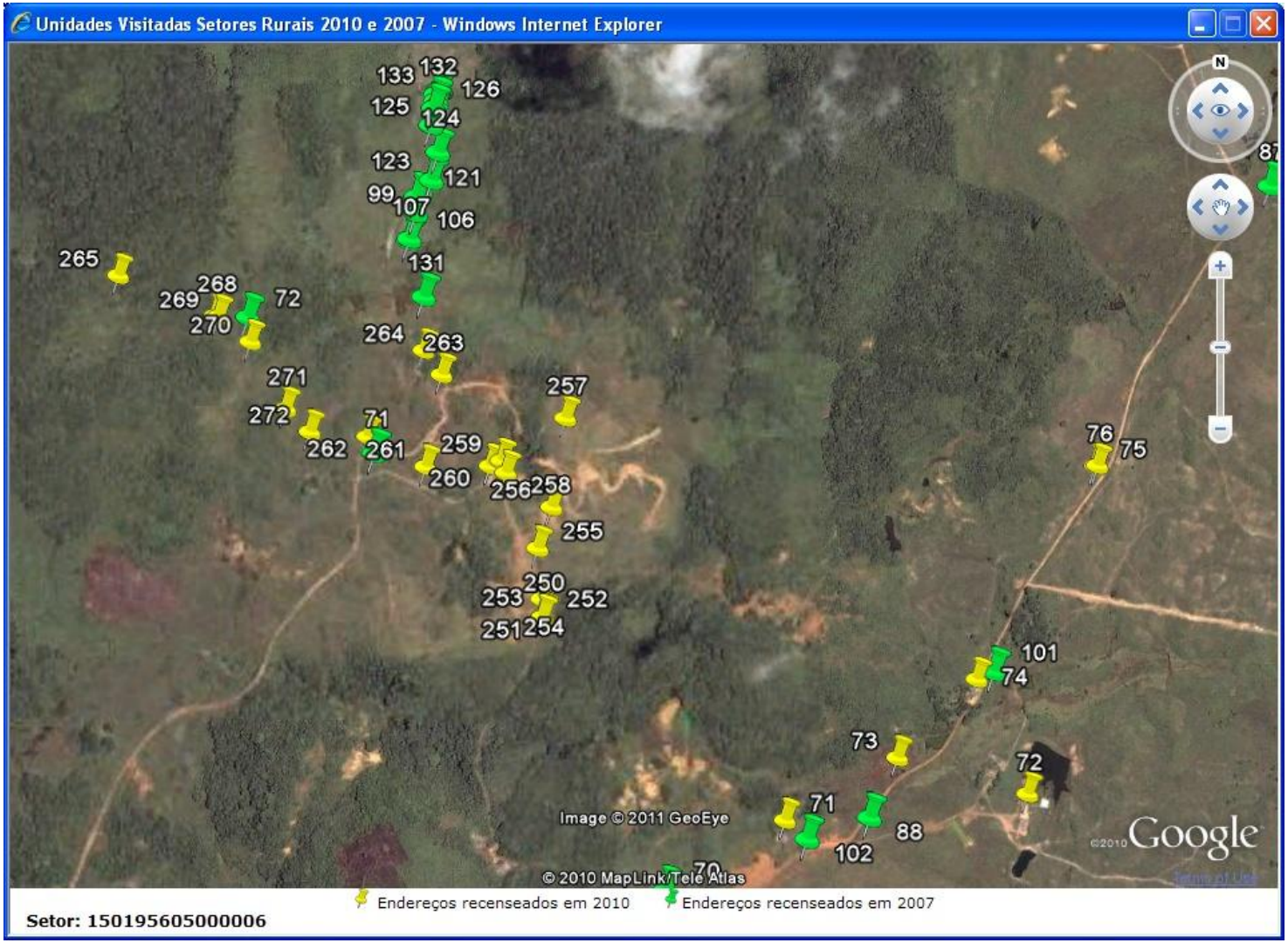
SIGC - Data Collection Management Indicators System

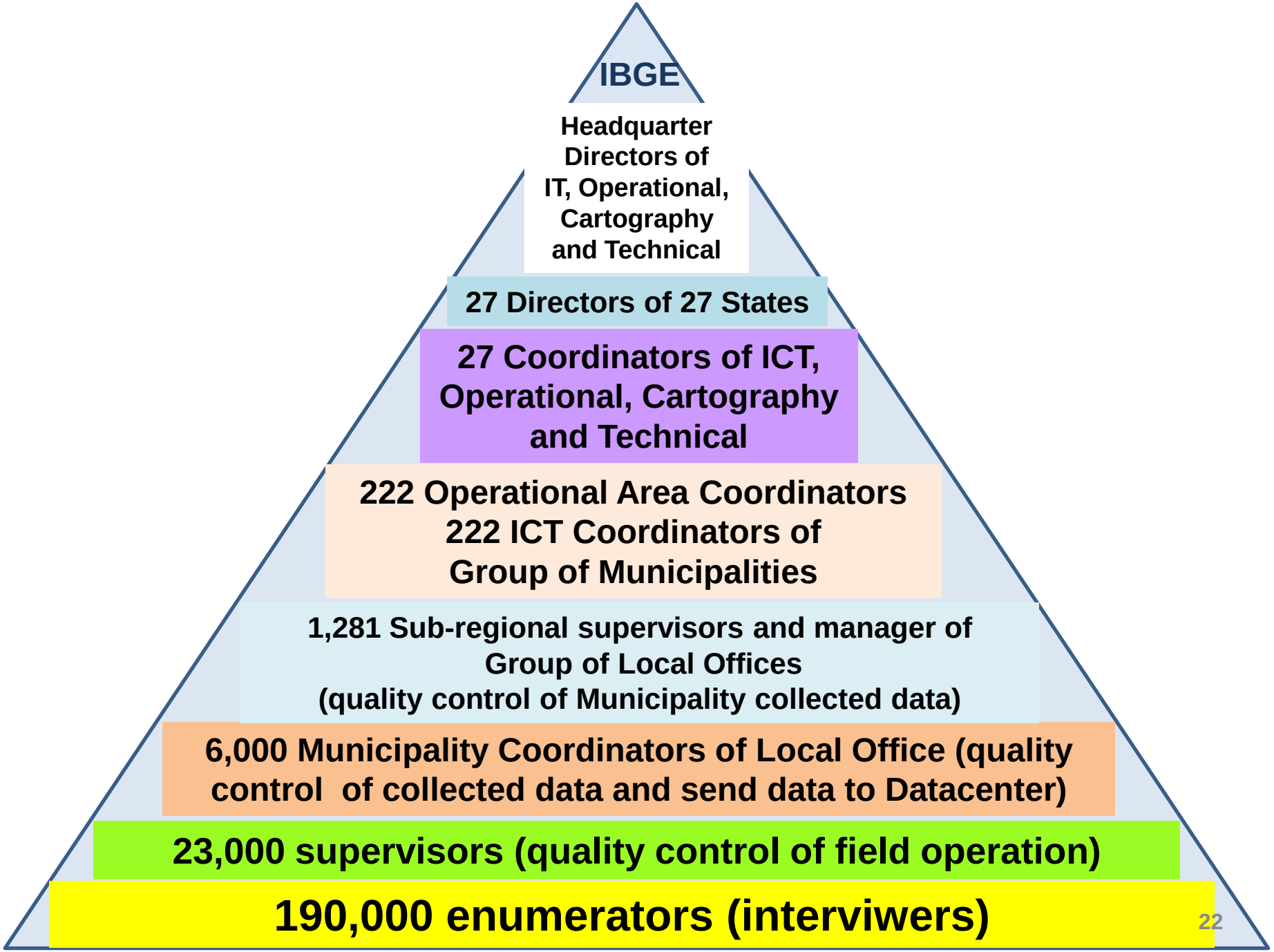


Data Collection Central Control Application

IBGE

SIGC - Data Collection Management Indicators System

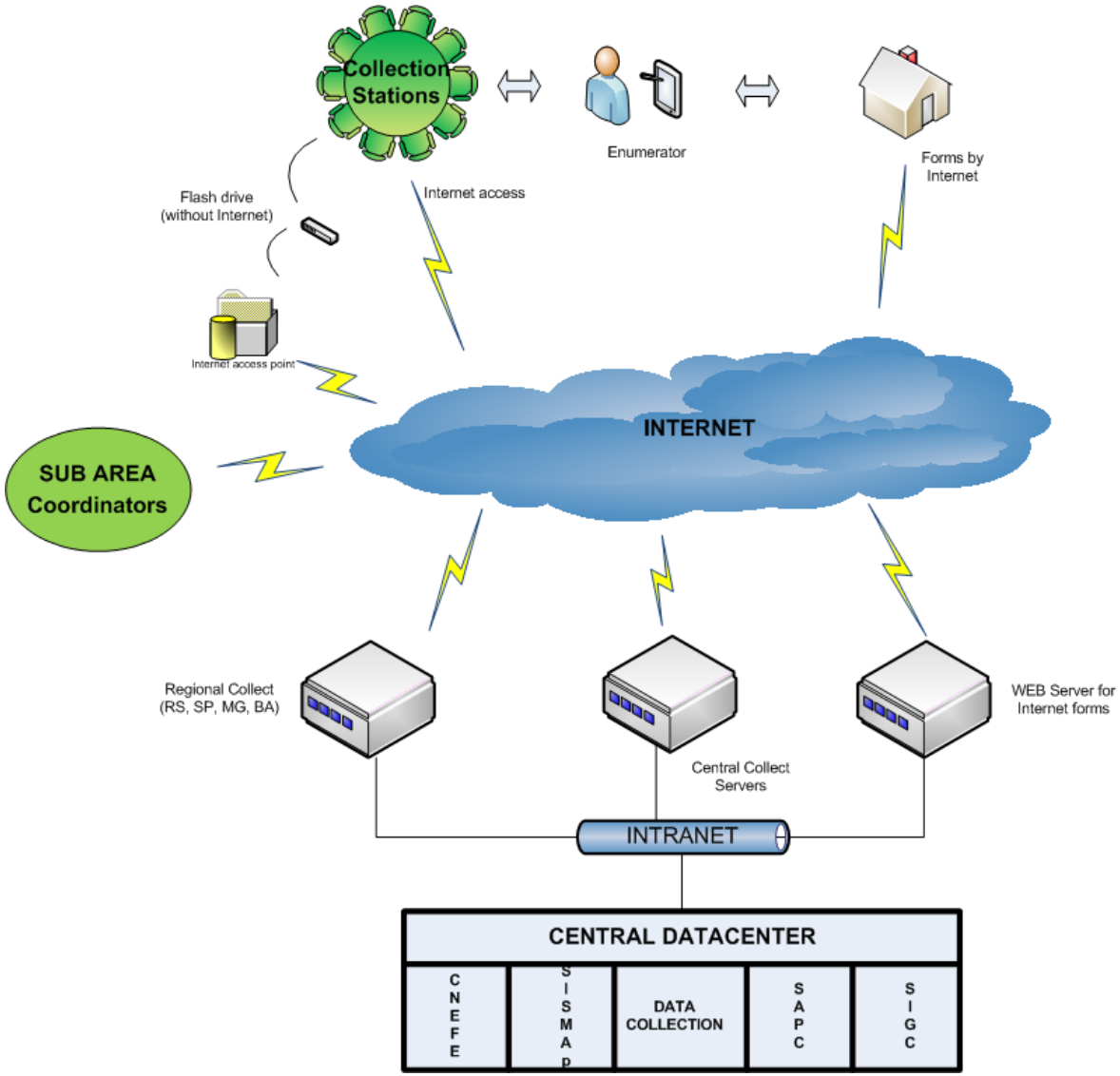



IBGE
Headquarter
Directors of
IT, Operational,
Cartography
and Technical
27 Directors of 27 States
27 Coordinators of ICT,
Operational, Cartography
and Technical
222 Operational Area Coordinators
222 ICT Coordinators of
Group of Municipalities
1,281 Sub-regional supervisors and manager of
Group of Local Offices
(quality control of Municipality collected data)
6,000 Municipality Coordinators of Local Office (quality
control of collected data and send data to Datacenter)
23,000 supervisors (quality control of field operation)
190,000 enumerators (interviwers)

ICT for Brazilian Census Data Collection

- **All data collection made with Personal Digital Assistant - PDA (there was no paper questionnaire).**
- **Each PDA was equiped with Enumerator Area Map; Questionnaires (short and long) and List of Address.**
- **7,000 Census Collection Stations equipped with notebooks**
  - Census Collection Stations were equipped to operate autonomously, connected or not, to the Internet;
  - Interaction of PDAs was made solely on the notebooks of the Collection Station, regardless of a network of synchronous communication with the Central Processing;
  - In Collection Stations **without** Internet connection, communication with the Central Processing was done through 14,000 USB drives (Pen drives) physically carrying lots of information to some other point of Internet access.
  - All ICT technical assistance (software, hardware and communication) were provided by 220 ICT Area Coordinators.

ICT model in the 2010 Census

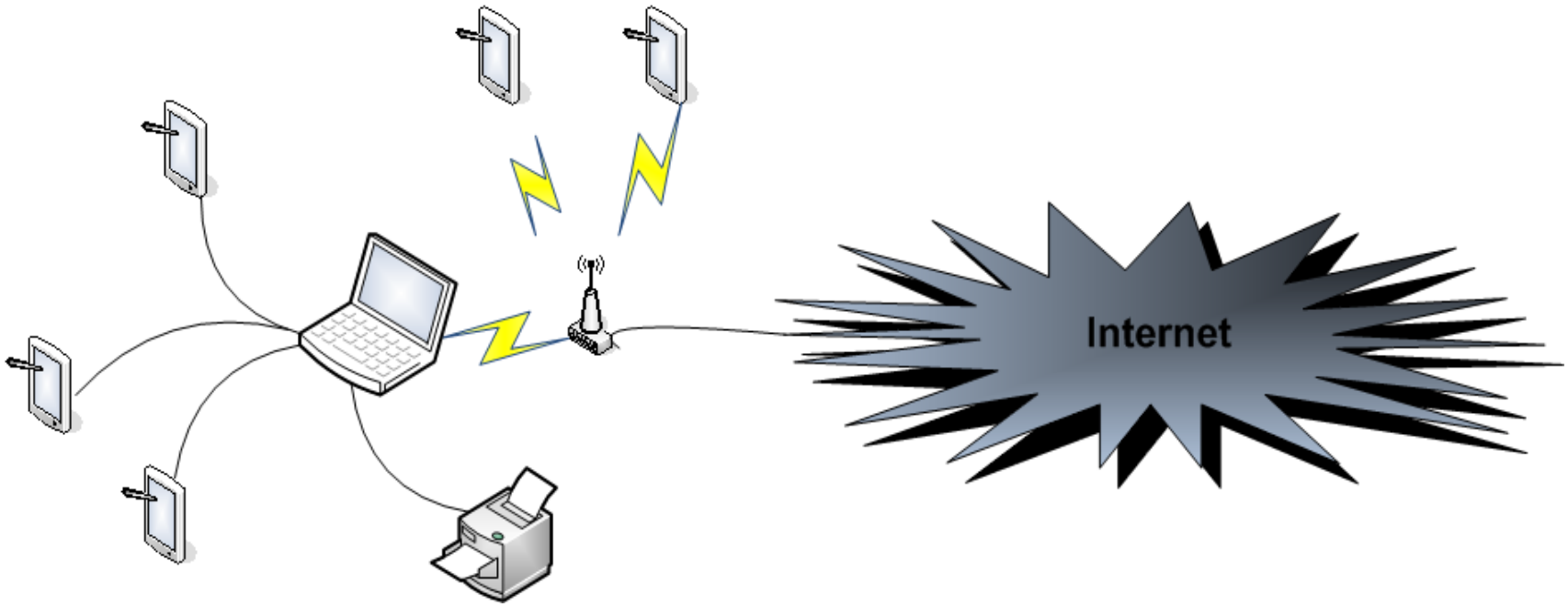


ICT in Data Collection

- 150,000 LG-750Q, smartphones locked (Phone, 3G) to be used solely as data collection equipment and programs certified by the IBGE
- 70,000 PDA MIO-P550B (already used in 2007)

ICT in the 7,000 Census Collection Stations

- **Notebook: 1 per 5 supervisors (8,687 notebooks)**
  - Blocked by “Content Advisor”
- **Router: 1 per Local Office (7,000 WiFi routers)**
- **Printer: 1 per Local Office**
- **Internet (where possible) or flash drive for physical transport of information for another place with access on Internet**
- **Supervisor an Enumerator: 1 PDA - MIO or LG**



ICT in the 1,2281 Sub Area

The 7,000 Collection Stations were supported and supervised by these 1,281 Sub Area Coordinators.

One of the duties of these coordinators was to visit Local Offices under their supervision to provide quality control of collected data and organization.

Equipments:

- **Notebook: 1 per coordinator (1,300 notebooks)**
- **Desktop computer: 1 per Sub Area**
- **Router (with VoIP): 1 per office**
- **Multifunctional printer: 1 per office**
- **Broadband Internet**
- **3G Modem: 1 per coordinator**

Communication Resources

- **2 links of 155 Mb/s for the exclusive operation of the Census 2010 in Rio de Janeiro (Headquarter)**
- **2 links of 20 Mb/s in São Paulo and Minas Gerais**
- **2 links of 12 Mb/s in Bahia and Rio Grande do Sul**
- **Subarea Coordination and Census Collection Stations :**
  - 3,783 mini modems 2G/3G
  - 139 antennas VSAT (Hughes)
  - 40 antennas BGAN (Tesacom)
  - 4,000 ADSL connections (leased, or by courtesy of others)
  - 1,000 Radio connections
  - 300 other types of connections

Data volumes

TRANSMISSIONS		**25,029,015 (files)**	**3,069,097.91 MB (transmitted data)**
Pre Census	6,818 stations	131,303	20,957.27 MB
Data Collection	314,017 E.A.	10,347,094	2,783,161.34 MB
Summary	6,831 stations	540,016	10,340.00 MB
Supervision	313,972 E.A.	13,658,485	251,090.00 MB
Post Census	1,921 stations	9,222	812.23 MB
Administrative	6,809 stations	312,816	2,680.00 MB
Internet forms	2,290 stations	30,079	57.07 MB
CENTRAL DATABASE		**281 (tables)**	**397,517.00 MB (data store)**

2010 Brazilian Census
First Results

Sampling Census

Population	Sampling	Number of Municipalities
Less than 2.500 inhabitants	50%	260
Between 2.501 and 8.000 inhabitants	33%	1.912
Between 8.001 and 20.000 inhabitants	20%	1.749
Between 20.001 and 500.000 inhabitants	10%	1.604
More than 500.000 inhabitants	5%	40
Total	11%	5.565

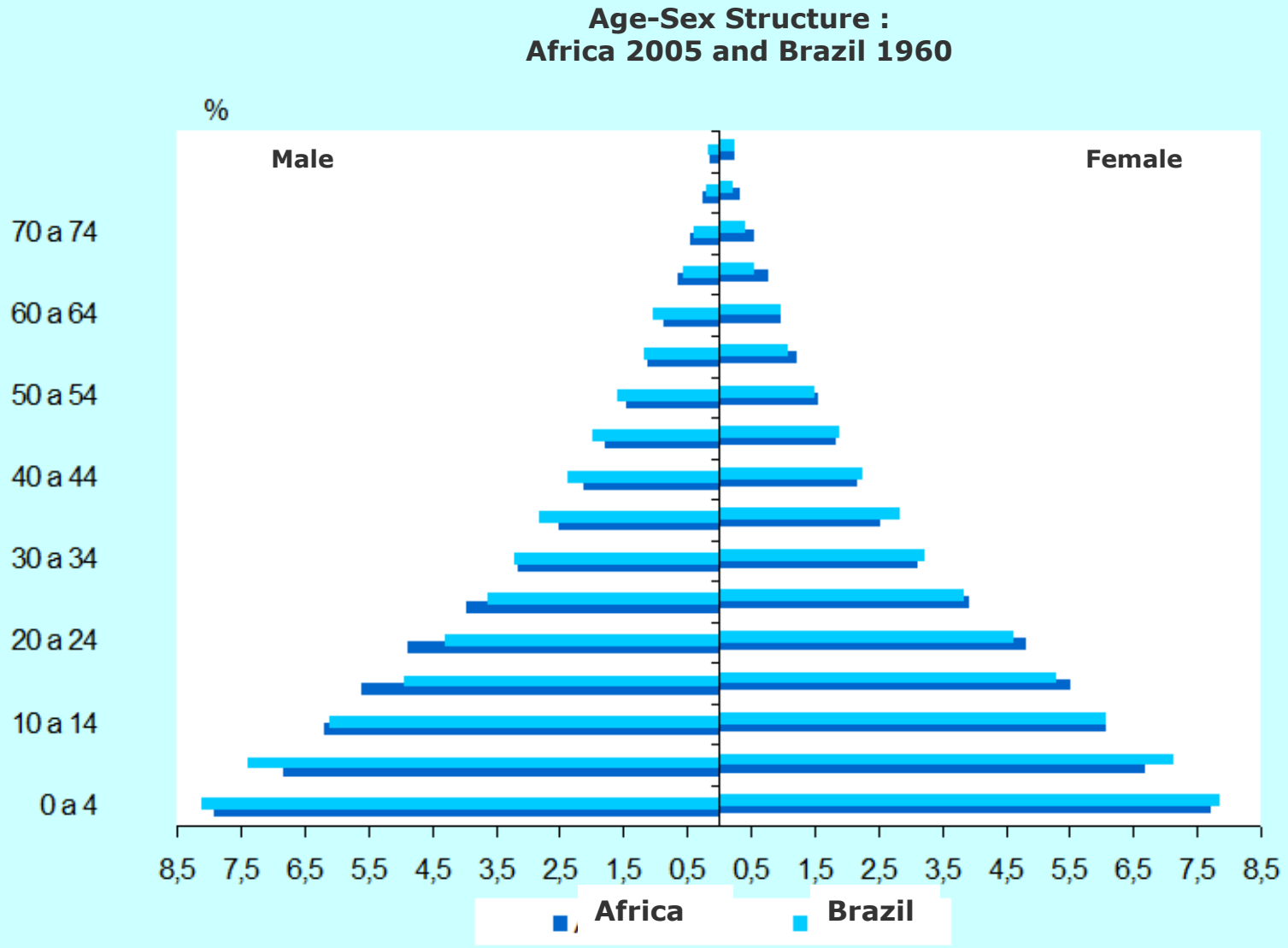
Source: IBGE, 2009 Brazilian Population.

Quality of Brazilian 2010 Census Data

- Field works: 1st August to 31st October 2010
- Last quality control supervisions: November 1st – 24th
- Imputation of population in closed housing units: November 25th - 26th
- Release of first results: November 27th 2010
- ETL the database: 1st December to 31st January 2011
- **Figures from Census 2010**

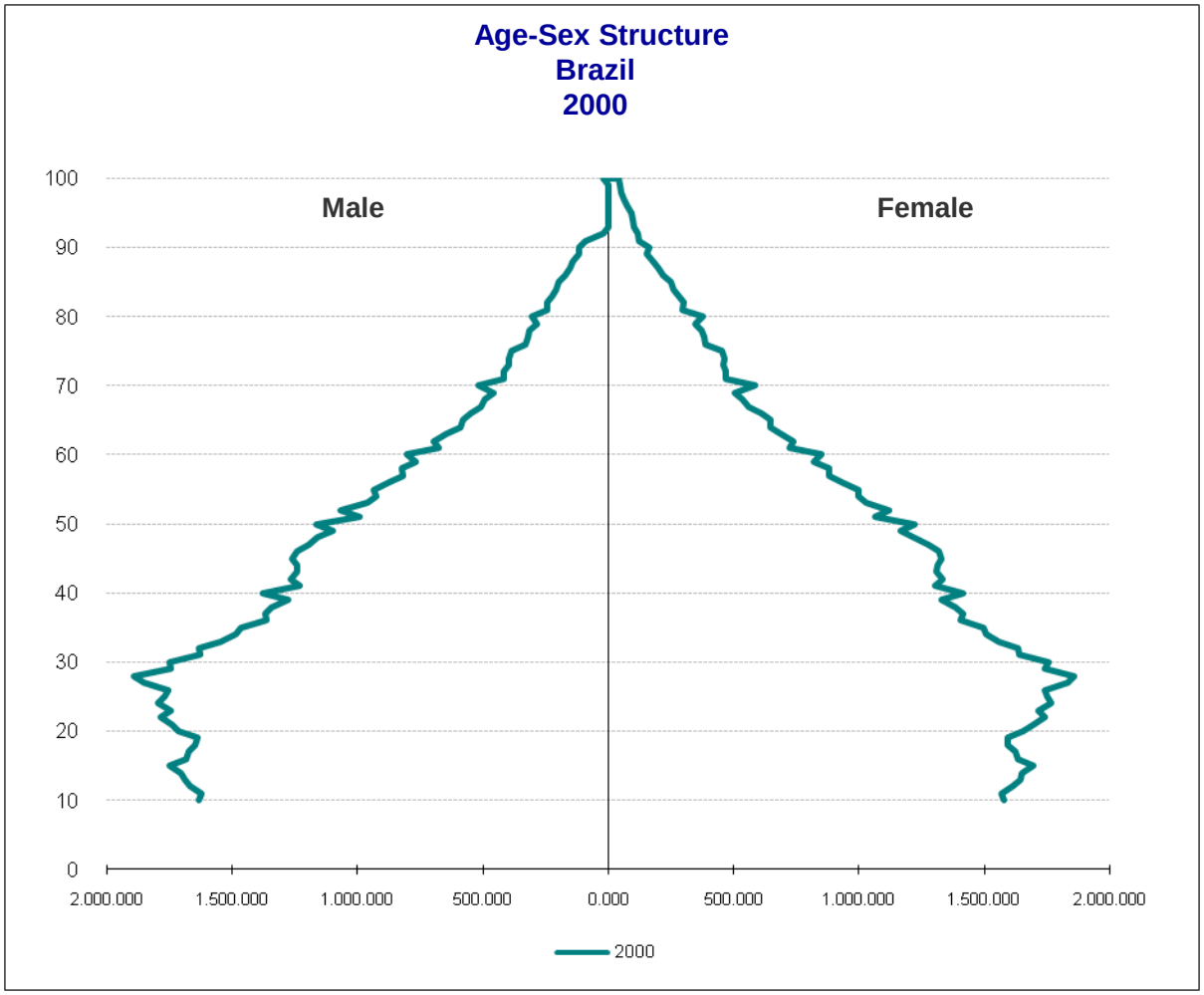
Brazilian population	190,732,694
Housing units surveyed	67,491,720
Occupied housing units	56,541,472
Closed housing units	901,169
Not occupied housing units	6,071,568
Occasional Use housing units	3,932,990
Address File (CNEFE)	83,026,526

Brazil - 50 years ago



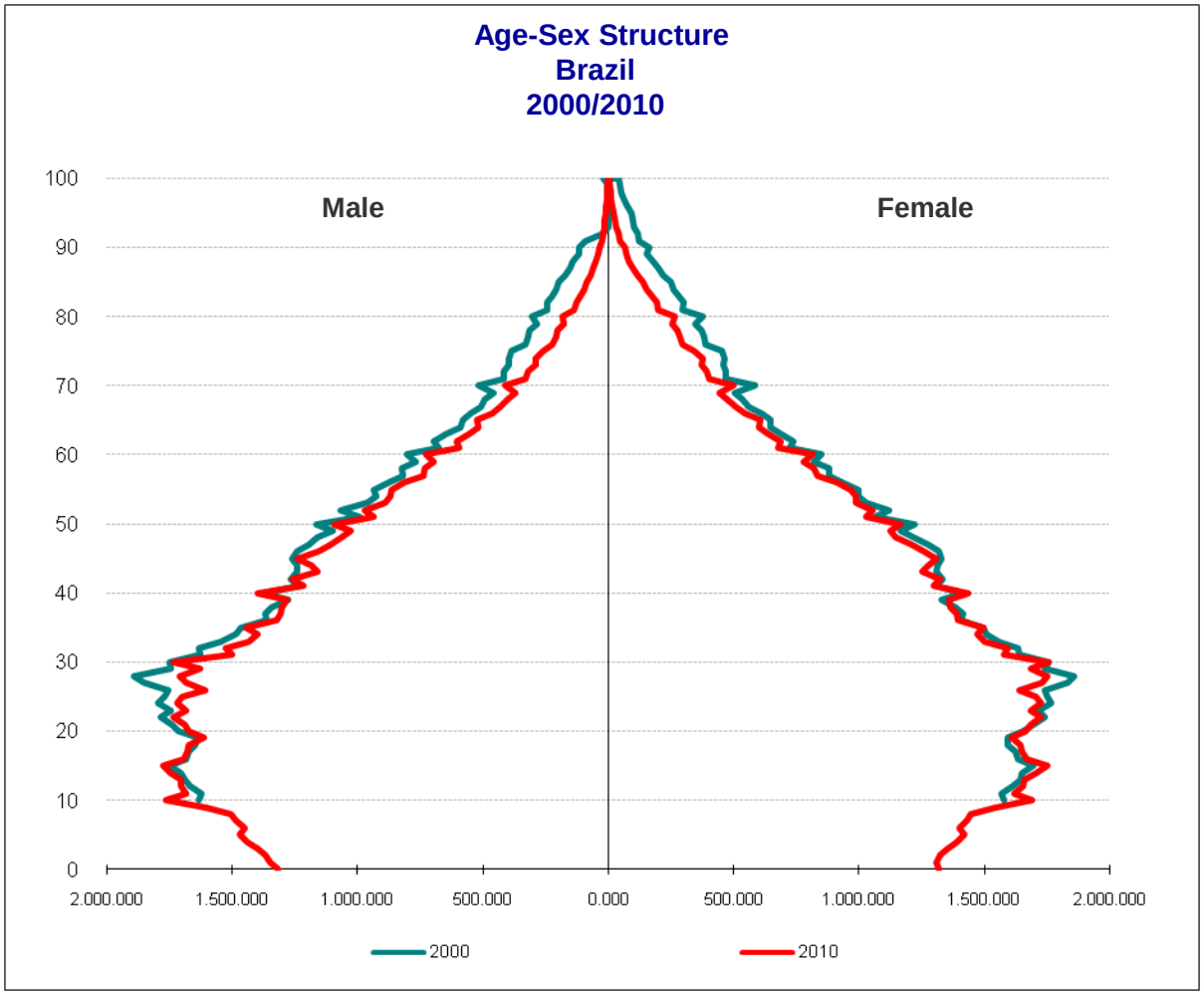
Fonte: IBGE, Censo Demográfico 1960 e UNITED NATION POPULATION DIVISION, World Population Prospects: The 2004 Revision Population Database, http://esa.un.org/unpp - 2006

2010 Census – timely and quality data



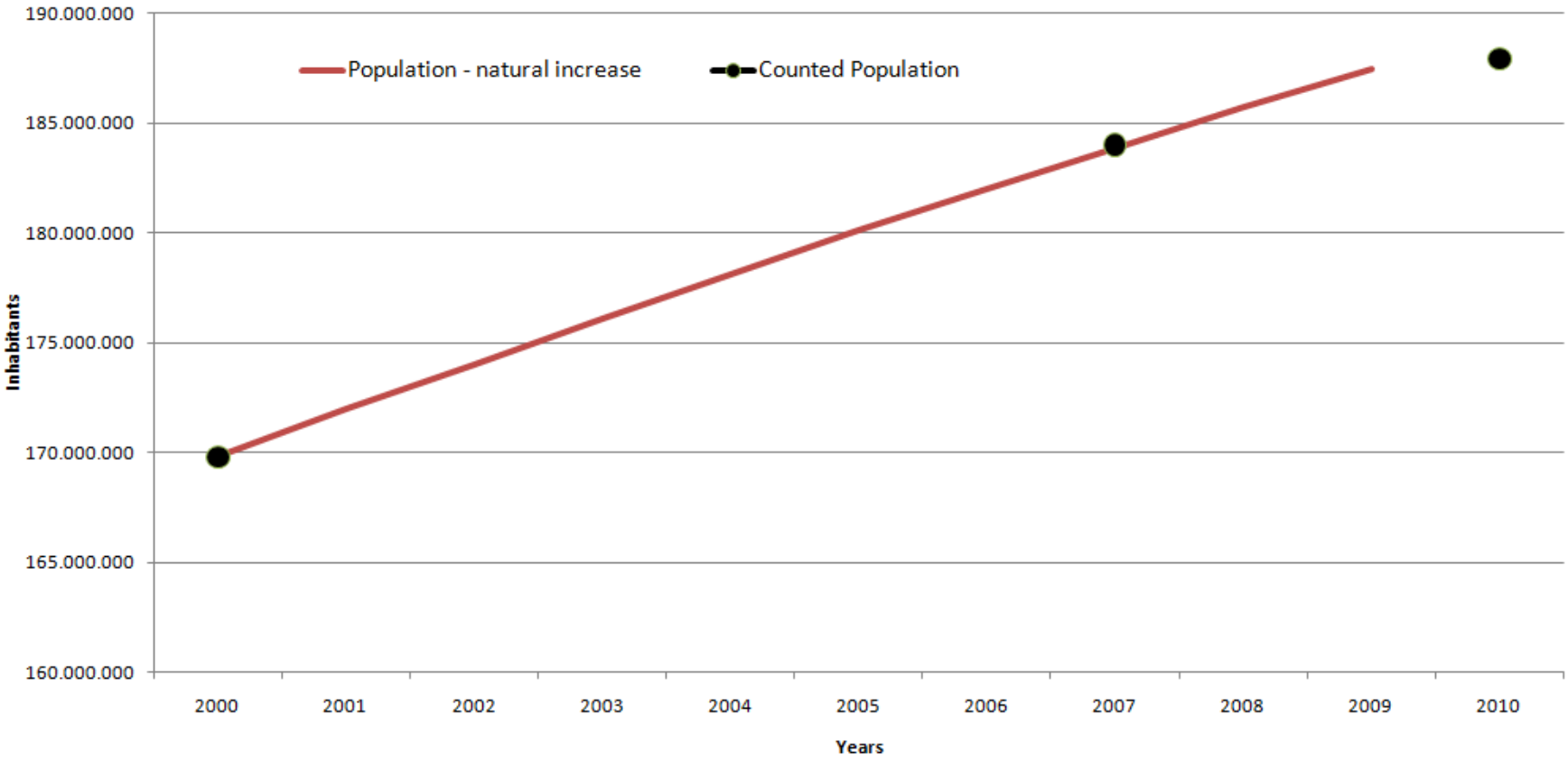
Source: IBGE. 2000 Population Census.

2010 Census – timely and quality data



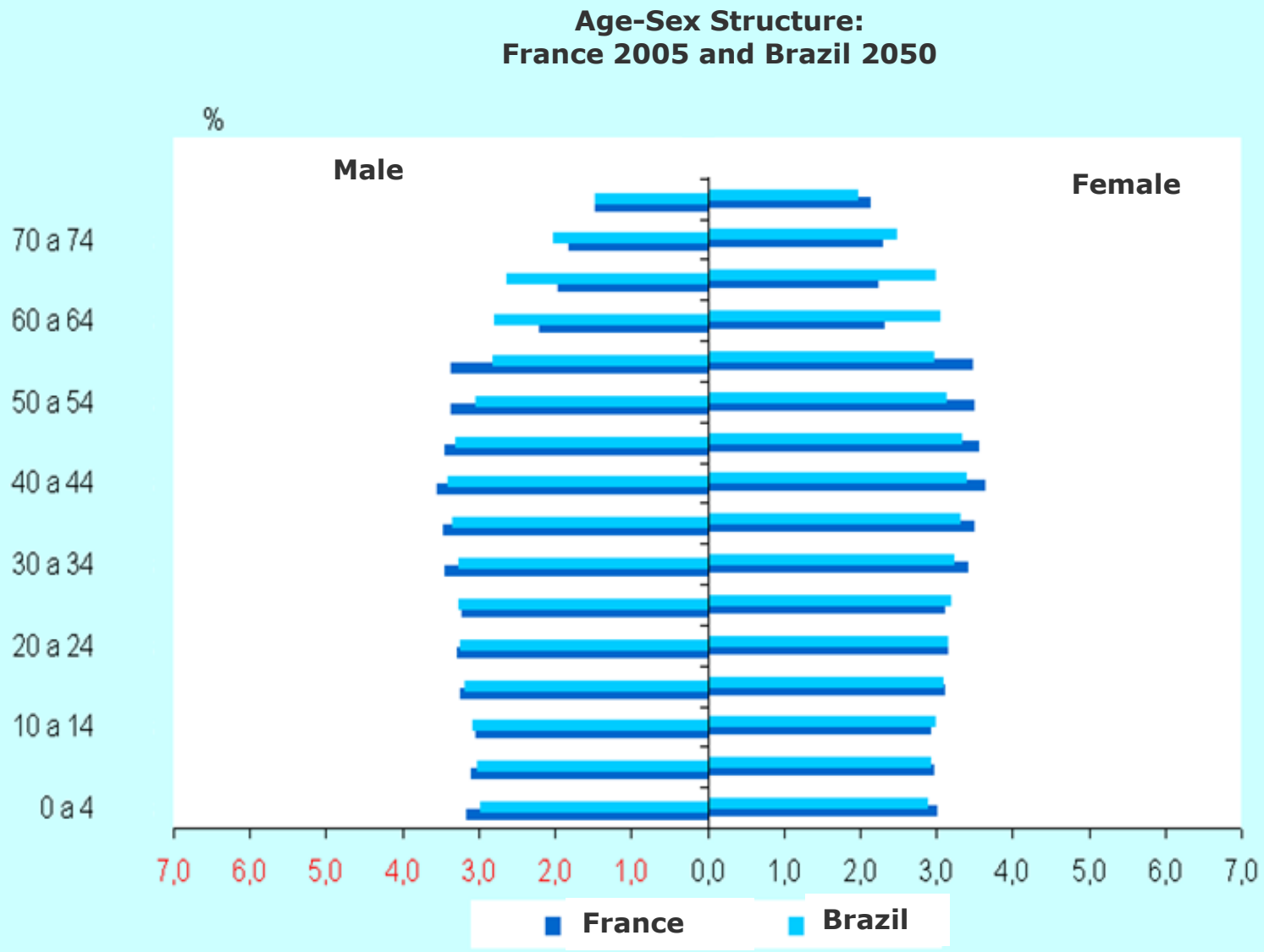
Source: IBGE. 2000 and 2010 Population Censuses.

Population Growth 2000 - 2010
Brazil

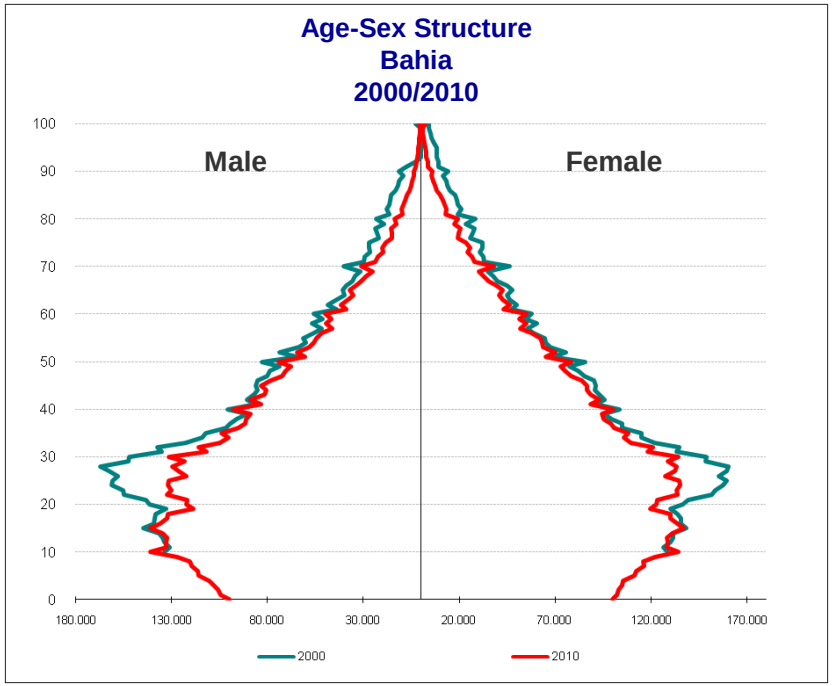


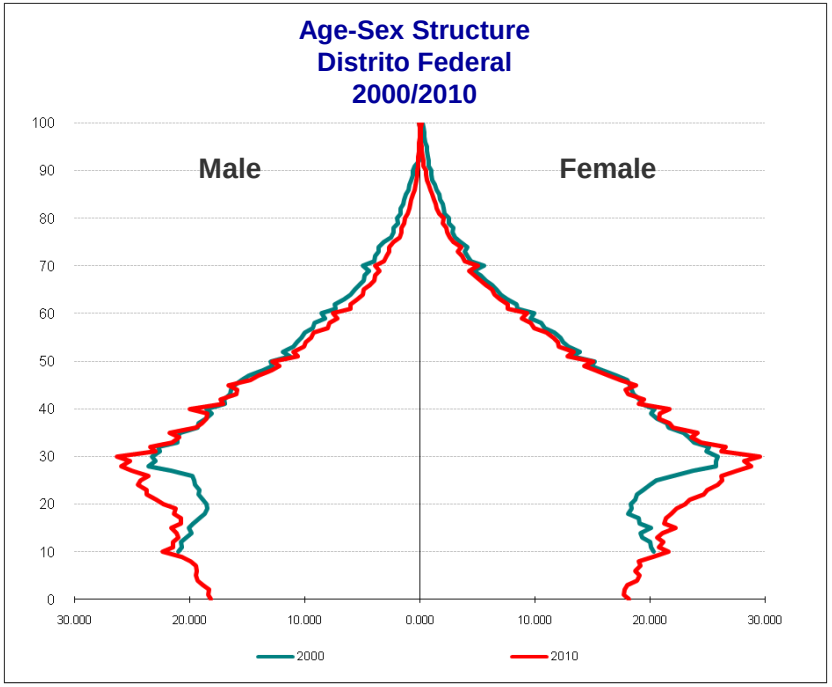
Source: IBGE. 2000 and 2010 Population Cenususes. 2007 Population Count.
Note: Population according to the natural increase considering births and deaths data from the MS/SVS/DASIS - SINASC and SIM / Datasus.

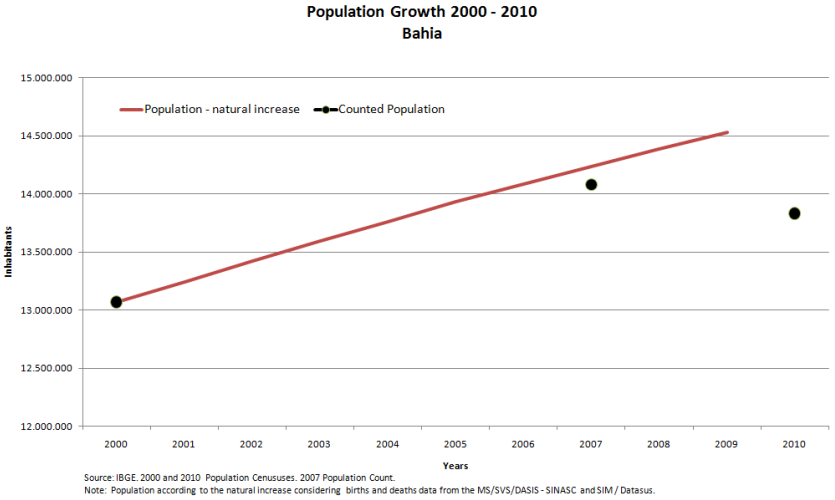
Brazil 40 years ahead

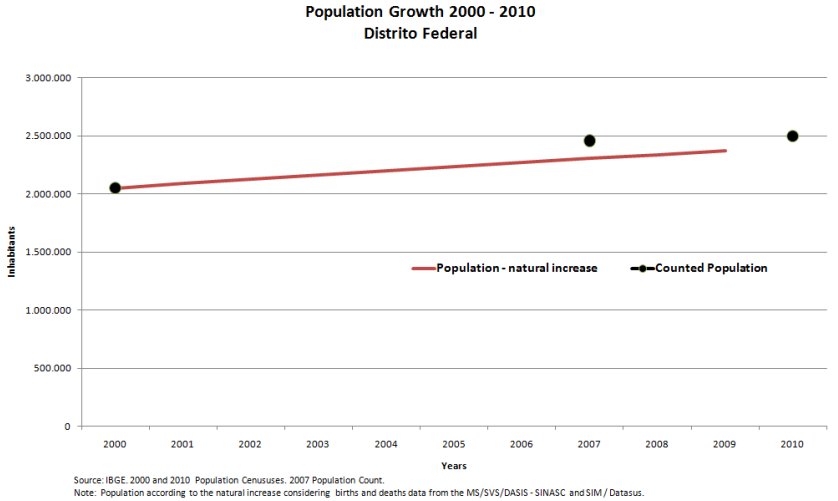


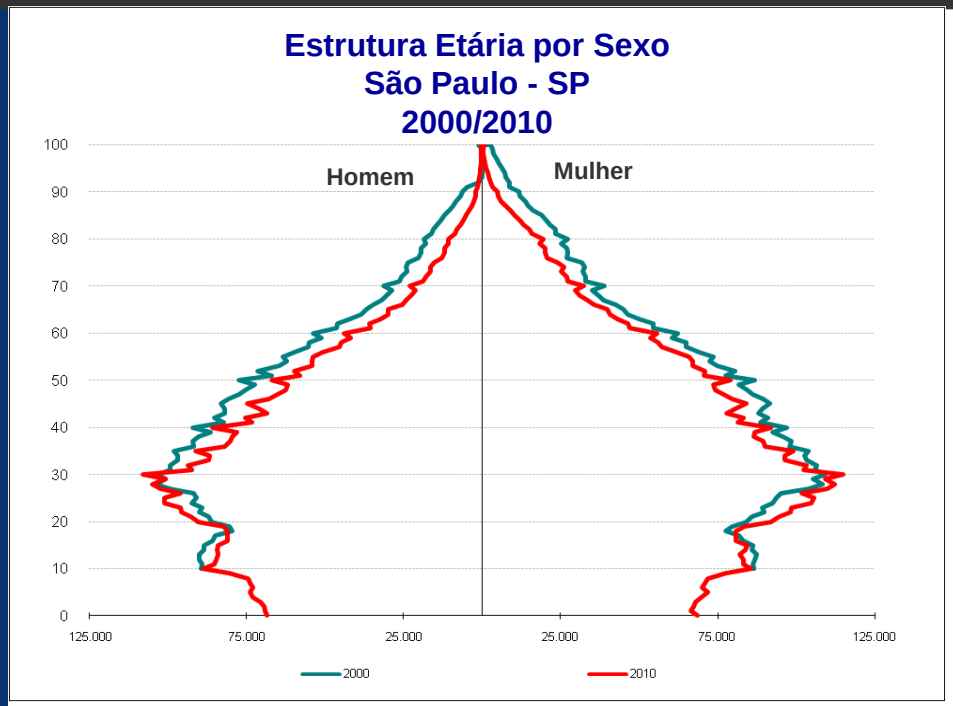
2010 Census – timely and quality data

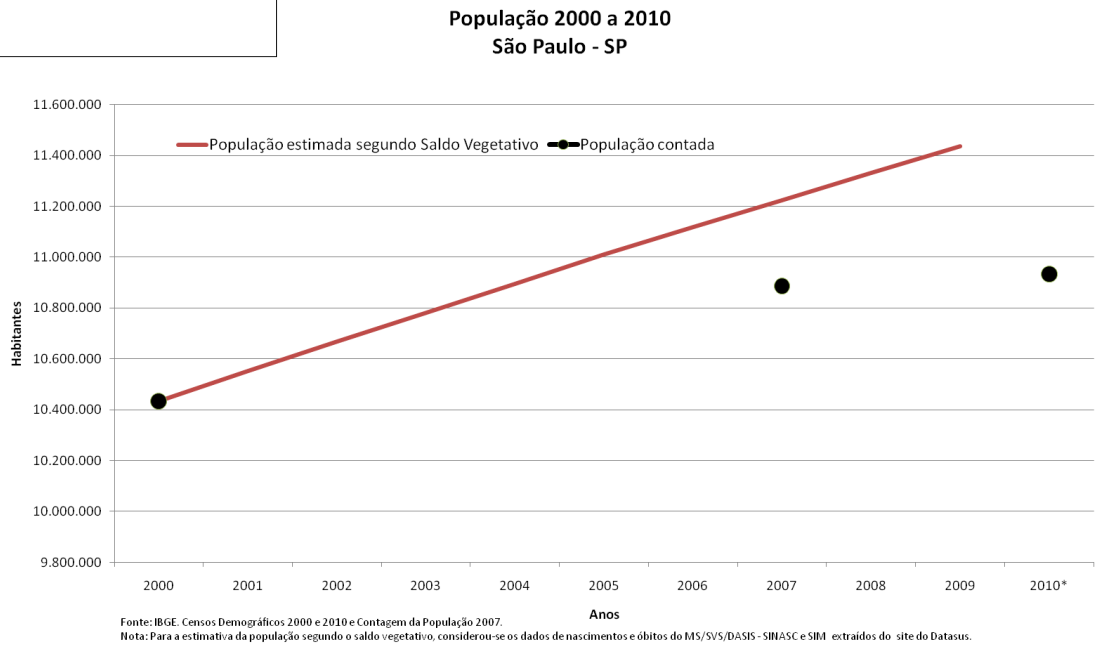




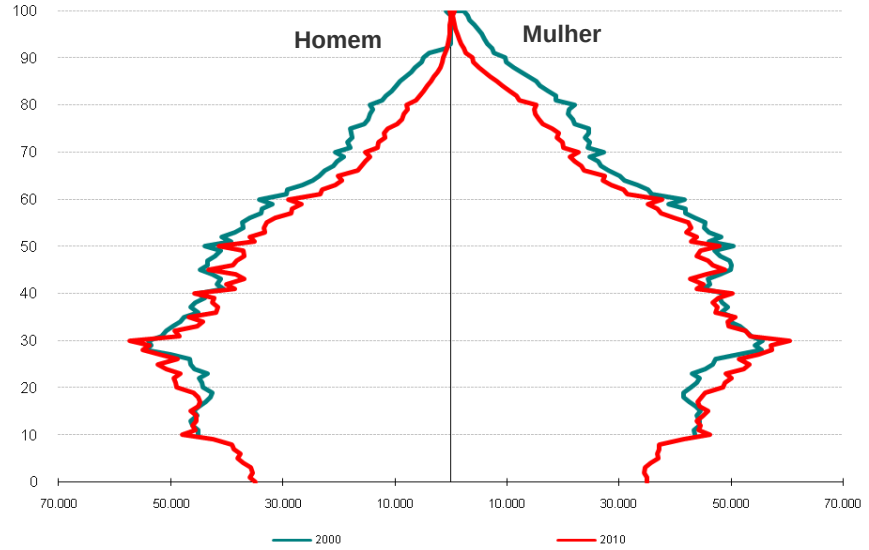




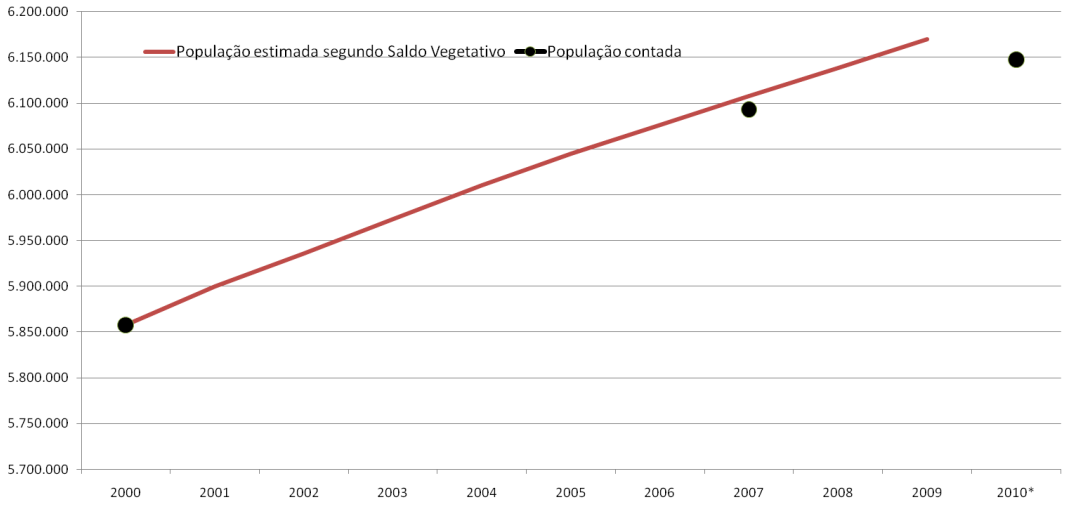

Estrutura Etária por Sexo
São Paulo - SP
2000/2010
Homem
Mulher
100
90
80
70
60
50
40
30
20
10
0
125.000
75.000
25.000
25.000
75.000
125.000
2000
2010


População 2000 a 2010
São Paulo - SP
População estimada segundo Saldo Vegetativo
População contada
Habitantes
11.600.000
11.400.000
11.200.000
11.000.000
10.800.000
10.600.000
10.400.000
10.200.000
10.000.000
9.800.000
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010*
Anos
Fonte: IBGE. Censos Demográficos 2000 e 2010 e Contagem da População 2007.
Nota: Para a estimativa da população segundo o saldo vegetativo, considerou-se os dados de nascimentos e óbitos do MS/SVS/DASIS - SINASC e SIM extraídos do site do Datasus.

Estrutura Etária por Sexo
Rio de Janeiro - RJ
2000/2010



População 2000 a 2010
Rio de Janeiro - RJ



Fonte: IBGE. Censos Demográficos 2000 e 2010 e Contagem da População 2007.
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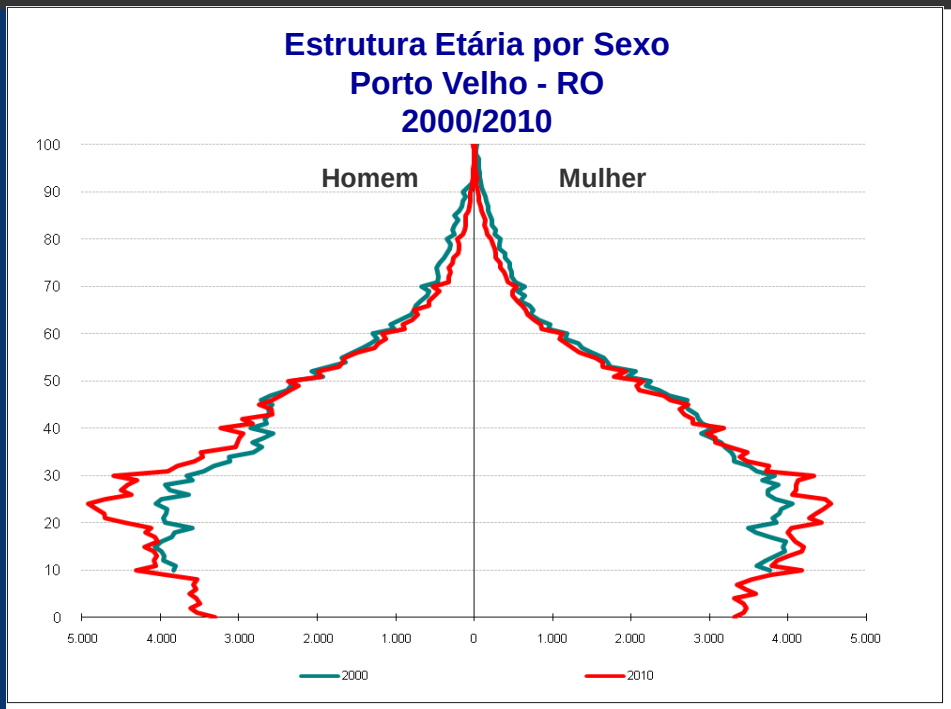

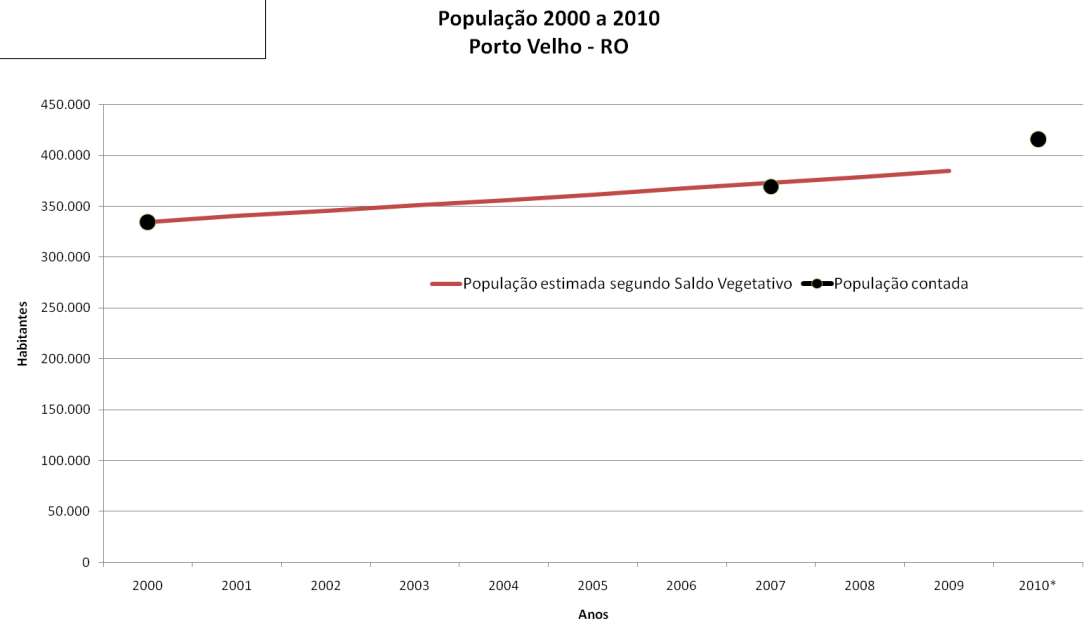

Fonte: IBGE. Censos Demográficos 2000 e 2010 e Contagem da População 2007.
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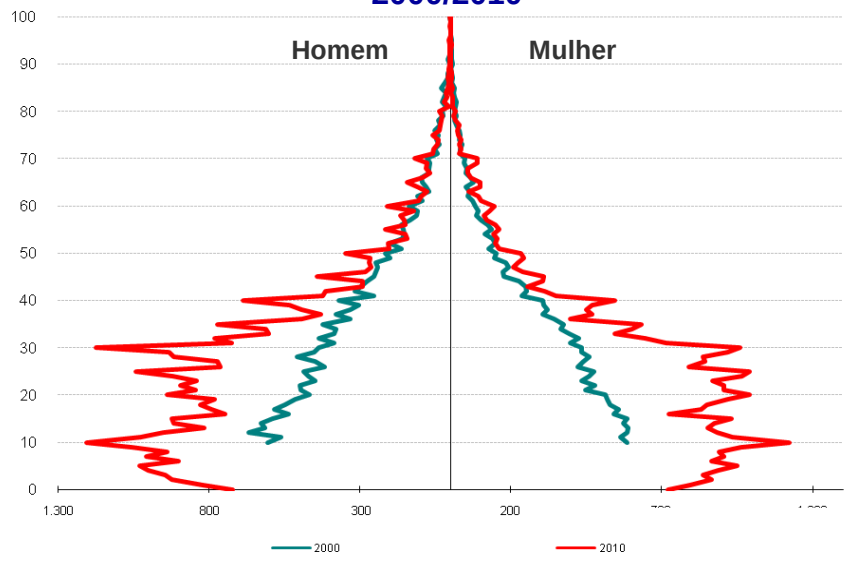
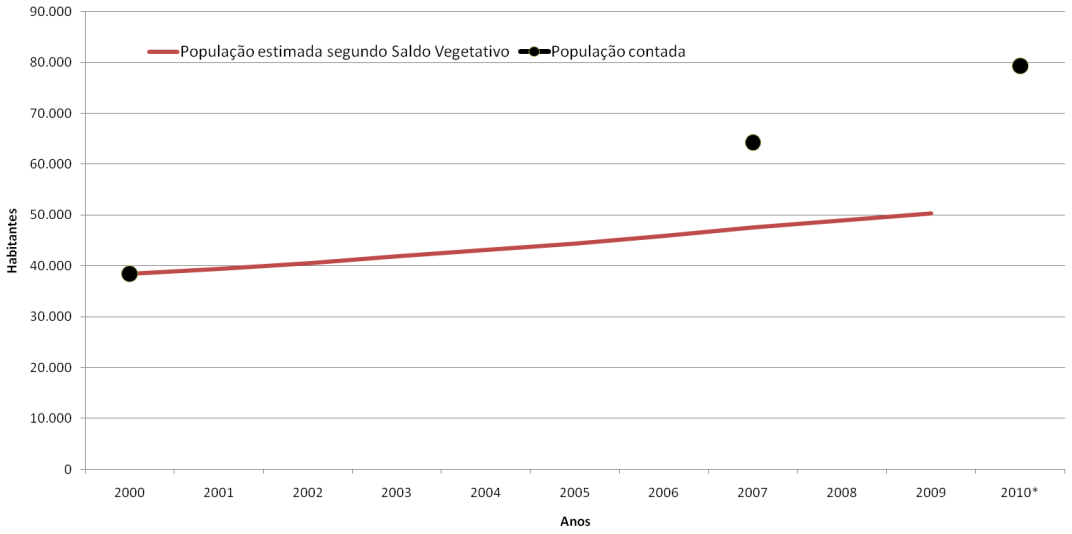
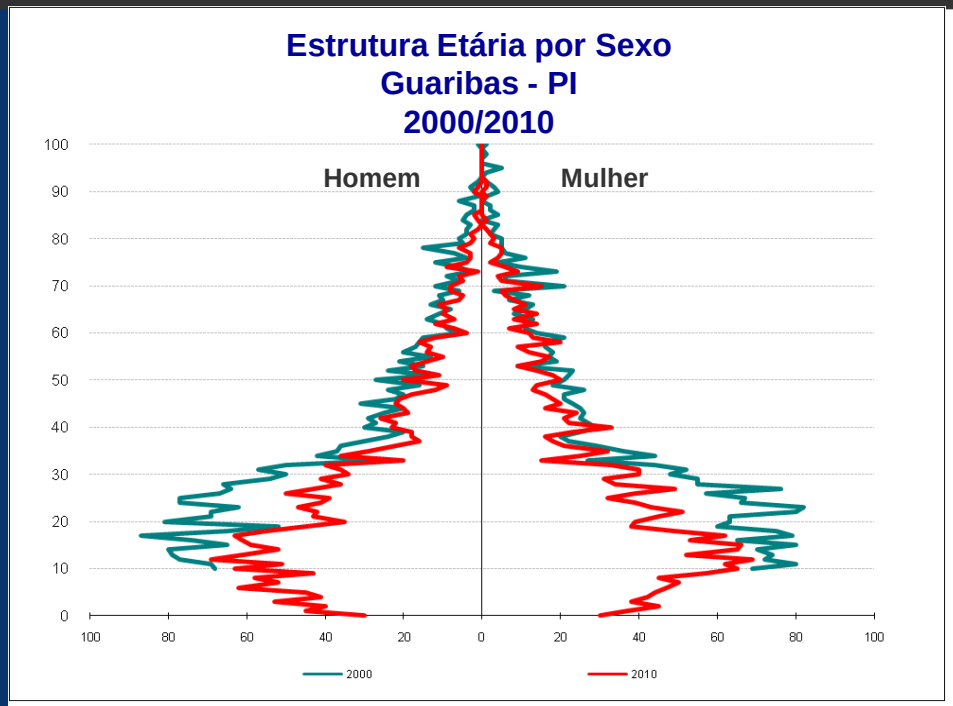
Estrutura Etária por Sexo
Tailândia - PA
2000/2010

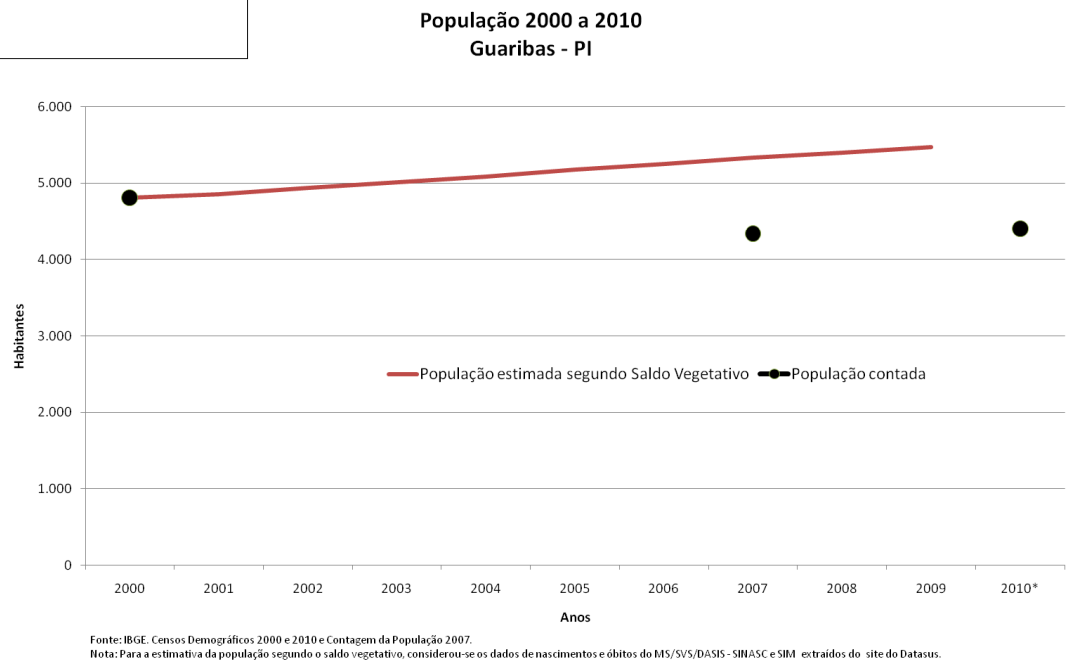


População 2000 a 2010
Tailândia - PA



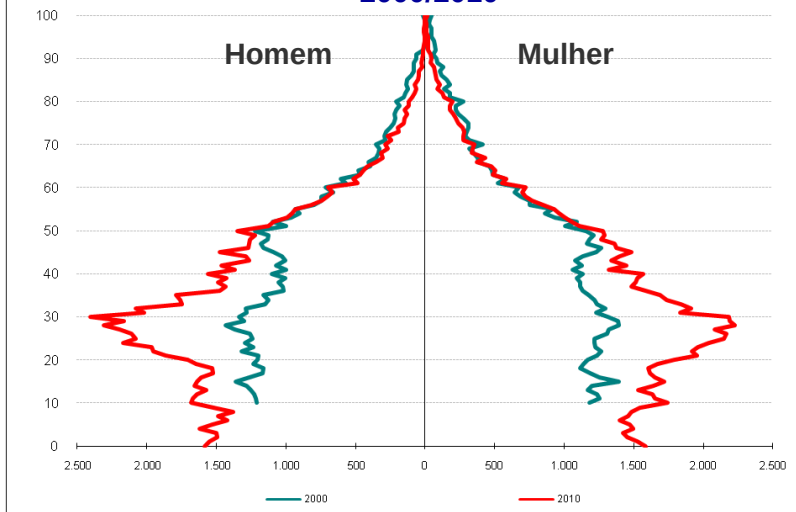
Fonte: IBGE. Censos Demográficos 2000 e 2010 e Contagem da População 2007.
Nota: Para a estimativa da população segundo o saldo vegetativo, considerou-se os dados de nascimentos e óbitos do MS/SVS/DASIS - SINASC e SIM extraídos do site do Datasus.



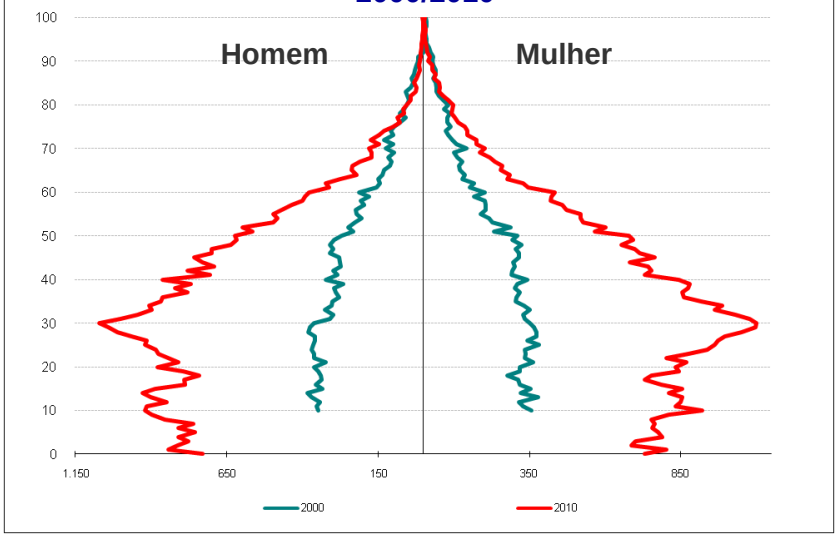


Fonte: IBGE. Censos Demográficos 2000 e 2010 e Contagem da População 2007.
Nota: Para a estimativa da população segundo o saldo vegetativo, considerou-se os dados de nascimentos e óbitos do MS/SVS/DASIS - SINASC e SIM extraídos do site do Datasus.

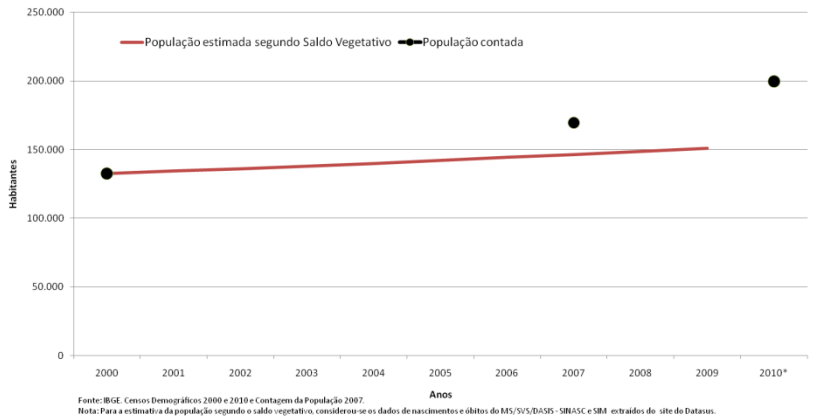
Estrutura Etária por Sexo
Macaé - RJ
2000/2010



Estrutura Etária por Sexo
Rio das Ostras - RJ
2000/2010

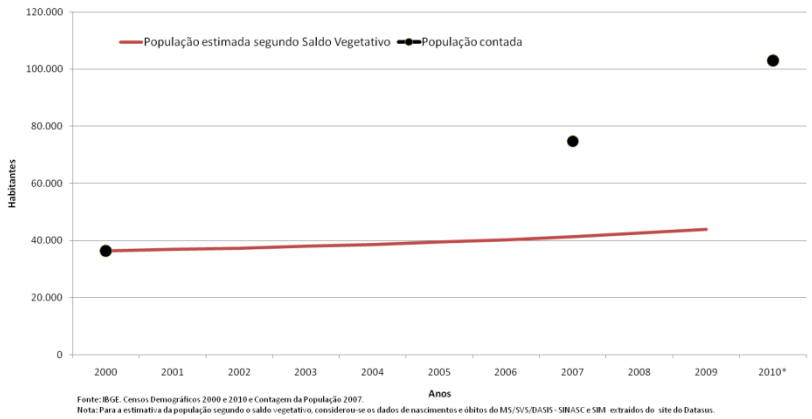


População 2000 a 2010
Macaé - RJ

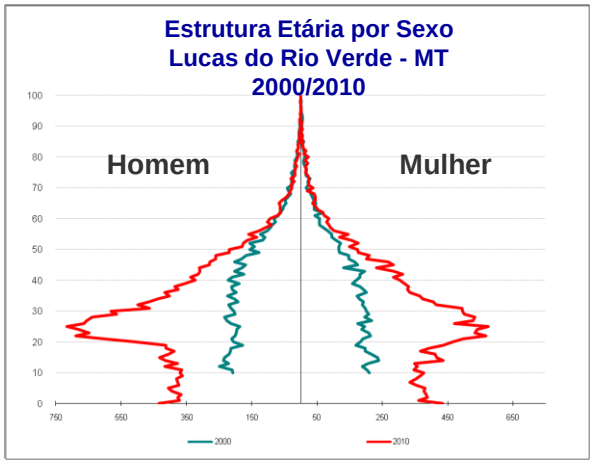


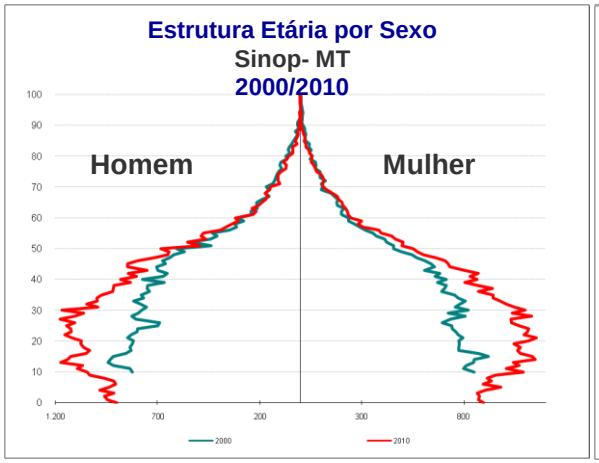
Fonte: IBGE. Censos Demográficos 2000 e 2010 e Contagem da População 2007.
Nota: Para a estimativa da população segundo o saldo vegetativo, considerou-se os dados de nascimentos e óbitos do MS/SVS/DASIS - SINASC e SIM extraídos do site do Datasus.

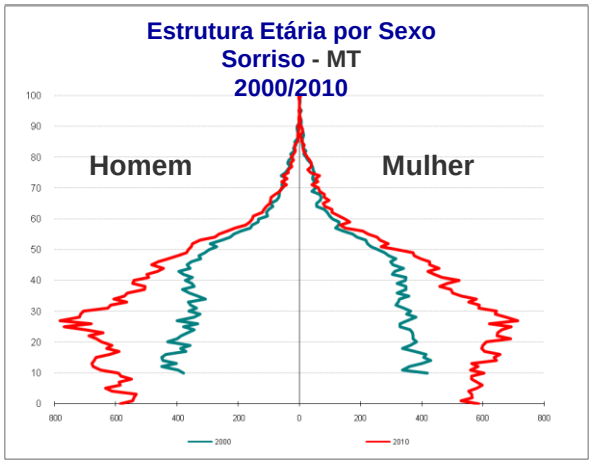
População 2000 a 2010
Rio das Ostras - RJ

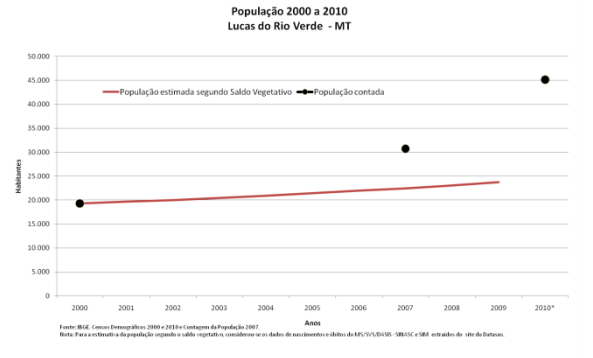


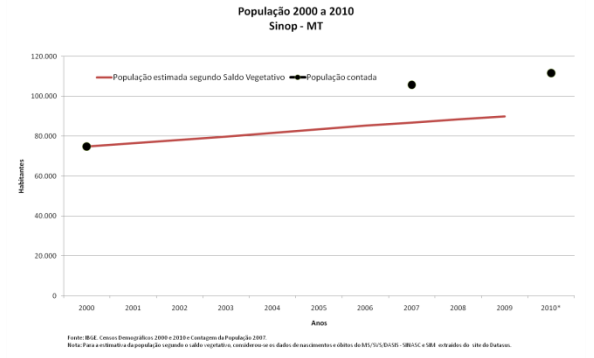
Fonte: IBGE. Censos Demográficos 2000 e 2010 e Contagem da População 2007.
Nota: Para a estimativa da população segundo o saldo vegetativo, considerou-se os dados de nascimentos e óbitos do MS/SVS/DASIS - SINASC e SIM extraídos do site do Datasus.

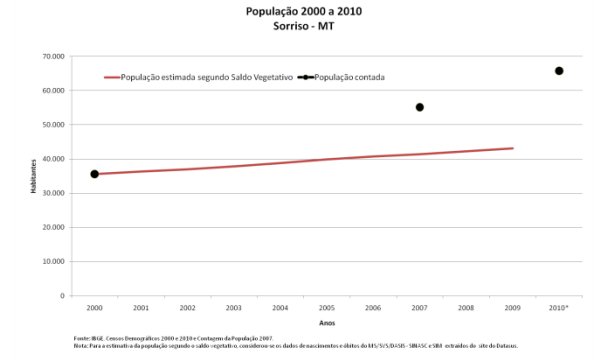

Estrutura Etária por Sexo
Lucas do Rio Verde - MT
2000/2010
Homem
Mulher
100
90
80
70
60
50
40
30
20
10
0
750
550
350
150
50
250
450
650
2000
2010


Estrutura Etária por Sexo
Sinop- MT
2000/2010
Homem
Mulher
100
90
80
70
60
50
40
30
20
10
0
1.200
700
200
300
800
2000
2010


Estrutura Etária por Sexo
Sorriso - MT
2000/2010
Homem
Mulher
100
90
80
70
60
50
40
30
20
10
0
800
600
400
200
0
200
400
600
800
2000
2010


População 2000 a 2010
Lucas do Rio Verde - MT
População estimada segundo Saldo Vegetativo
População contada
Habitantes
Anos
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010*


População 2000 a 2010
Sinop - MT
População estimada segundo Saldo Vegetativo
População contada
Habitantes
Anos
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010*


População 2000 a 2010
Sorriso - MT
População estimada segundo Saldo Vegetativo
População contada
Habitantes
Anos
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010*

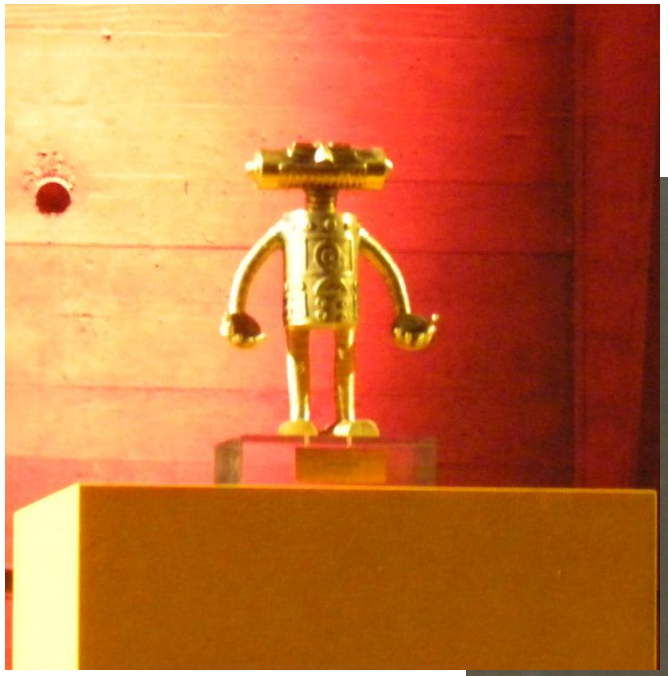
International Cooperation

Agreements of International Cooperation

- **Soth America**
  - Uruguay – 2011 Pop Census
  - Paraguay – 2012 Pop Census
- **North America**
  - USA – Population Census Methodology , Master File Adddresses and Census Cartography
- **Africa**
  - Cabo Verde – 2010 Pop Census
  - São Tomé e Príncipe – 2011-2012 Pop Census
  - Cabo Verde - Agriculture Statistics
  - Ethiopia – Agriculture Statistics

Brazilian Census 2010

Prize Unesco / NetExplorateur 2011



censo 2010

IBGE
Instituto Brasileiro de Geografia e Estatística