

National Institute of Statistics and Geography
Direction General of Geography and Environment

National Report 2008-2011



Introduction

This report was prepared for the Expert Group Meeting on Global Geospatial Information Management to be held on October 24 – 26 in the Republic of Korea. It summarizes the activities related to the geographic and environmental information performed by the Direction General of Geography and Environment of the National Institute of Statistics and Geography during 2008 through the first half of 2011.

The 26th and 73th articles of the Constitution of the United Mexican States, reformed in 2006, the Mexican State must have a National Statistical and Geographical Information System (SNIEG, Sistema Nacional de Información Estadística y Geográfica). In accordance, the Law of the National Statistical and Geographical Information System (LSNIEG, Ley del Sistema Nacional de Información Estadística y Geográfica) was passed by Congress to establish the general requirements for the constitution and organization of the System, including the technical and management autonomy the National Statistics and Geography Institute (INEGI), the organism in charge of regulating and coordinating the SNIEG.

The SNIEG is a set of public institutions organized in subsystems, coordinated by the INEGI and articulated through the National Information Network that produces and disseminates Information of National Interest through four subsystems: 1. Demographic and Social Information, 2. Economic Information, 3. Geographic and Environmental Information and 4. Information on Government, Public Security and Application of Justice.

The National Geographical and Environmental Information Subsystem is divided in two main components: geographic and environmental. The geographic component must generate at least the following data groups: geodetic reference frame; coastal, international, state and municipality boundaries; continental, insular and submarine relief; cadastre, topographic, natural resources and climate data, and geographical names. The environmental component must produce indicators about these themes: atmosphere, water, soil, flora, fauna, hazardous and solid waste. It must also describe the status and trends of the environment considering the natural resources, plant and animal species, and other organisms as well.

This report begins with the densification and validation of the National Geodetic Network, followed by the acquisition of aerial photographs and satellite imagery and the input for the production and updating of basic and natural resources cartography. It also contains the generation of topographic and thematic cartography such as edaphology, land use, potential land use, hydrology and climatology. Finally, other important activities like the development of geomatic solutions and the elaboration of technical standards for the production of geographic information are included.

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INPUT

1. Geodetic Frame

The Geodetic Reference Frame is part of the Subsystem of Geographical and Environmental Information in its geographic component and is one of the main elements for the development of the national geographic information. In this context, the Frame has implications related to the scientific, technological and economic development, as well as to the preservation of the environment and contribution to the economic and social sustainability of Mexico.

1.1 National Active Geodetic Network (RGNA)

At present, the [National Active Geodetic Network](#) (RGNA, Red Geodésica Nacional Activa) is formed by 22 continuous operating stations around the country, of which 20 belong to INEGI and 2 are cooperative stations –one from the Territorial Information Institute of Jalisco and the other from the Municipality Institute of Research and Planning, City of Juarez, Chihuahua.



Map of the National Active Geodetic Network Stations

1.2 National Passive Geodetic Network (RGNP)

The **National Passive Geodetic Network** (RGNP, Red Geodésica Nacional Pasiva) is composed of the vertical, horizontal, and gravimetric networks.

1.2.1 Vertical Geodetic Network

The **Vertical Geodetic Network** refers to the definition of the national territory heights with respect to a reference level, materialized by means of 26,108 benchmarks.

1.2.2 Horizontal Geodetic Network

The **Horizontal Geodetic Network** is the set of points located on the national territory physically established on monuments or marks more or less permanent, where direct measurements and support of physical parameter measurements were made, allowing their interconnection and positioning with respect to a reference system, International Terrestrial Reference Frame 2008, ITRF08, epoch 2010.0, associated to a reference ellipsoid defined in the Geodetic Reference System 1980, GRS80, using GPS geodetic vertices linked to the RGNA. This network has 77,024 geodetic vertices all over the national territory.

1.2.3 Gravimetric Network

The **Gravimetric Network** defines the external gravimetric field, materialized in a set of points established on the ground, where the acceleration of gravity is measured with respect to a reference system. So far 140,485 stations have been established, with 11,823 on a physical mark.

The next table presents a summary of the generation of validated geodetic points during 2008-2011:

| Year | Horizontal | Vertical | Gravimetry | Total: |
|---------------|---------------|---------------|---------------|---------------|
| 2008 | 7,386* | 1,235 | 960 | 9,581 |
| 2009 | 6,456 | 6,674 | 5,067 | 18,197 |
| 2010 | 4,548 | 3,891 | 3,710 | 12,149 |
| 2011 | 974 | 1,436 | 867 | 3,277 |
| Total: | 19,364 | 13,236 | 10,604 | 43,204 |

*4,684 stations belong to the project Fund for Natural Disasters Prevention (FOPREDEN, Fondo para la Prevención de Desastres Naturales).

** As of June 30, 2011.

The three networks' data is required for the georeference of geographic features and statistical data, for ground control in the production of orthophotos, as well as for providing input for the

development of the geoid solution, for the establishment of height systems and for technical support in the definition of international boundaries and territory limits.

2. Photogrammetric Flight and LIDAR

The capture of LIDAR data was oriented to obtain height data for the generation of digital elevation models.

The LIDAR data was mainly obtained for two physiographic regions of the country, as well as the States of Nuevo Leon and Guanajuato, and some other locations.

Since 2010, the INEGI decided to substitute its aerial fleet to generate geographic information through the high resolution satellite images.

The production was as follows:

| Flight type | 2008 | 2009 | 2010 | Total: |
|------------------------|----------------------------|----------------------------|------------------------|----------------------------|
| Photogrammetric flight | 219,954.31 km ² | 151,251.99 km ² | 22,739 km ² | 393,945.30 km ² |
| LIDAR flight | 140,344.96 km ² | 131,894.01 km ² | 27,628 km ² | 299,866.97 km ² |



National coverage of LIDAR data

3. LIDAR Data (km²) Point Cloud

In support of the geodetic works for the LIDAR survey, 7,962 cartographic formats 1:10,000 were generated, representing coverage of 326,372 km².

The territory surface coverage is about 16% of the country. With this cloud, relief data was generated using digital elevation, surface and terrain models.

4. Digital Elevation Models

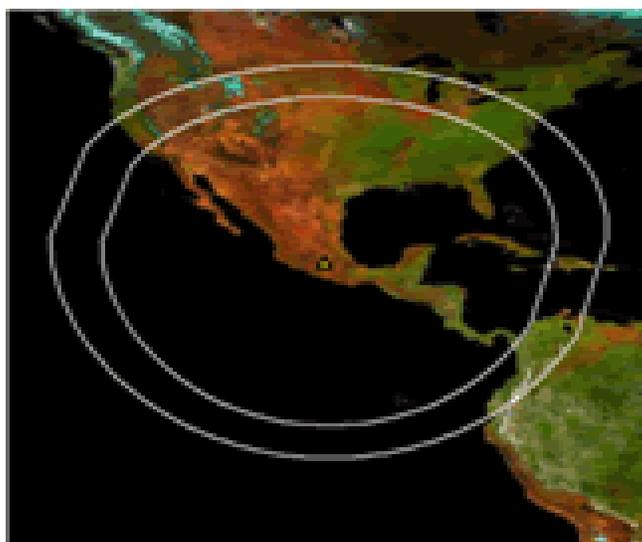
For the South and North Plains of the Gulf of Mexico, Nuevo Leon, Aguascalientes, Sonora, Distrito Federal, Chiapas, Tabasco and Rio Grijalva bed, 15,430 digital elevation models have been generated (7,715 are surface models and the same quantity are terrain models), in cartographic format scale 1:10,000, with a 5 m resolution.

5. Ground Stations (Satellite imagery)

The operations of the ground stations –ERMEXS (operated jointly by the Ministry of Agriculture, the Navy and INEGI) and ERIS– responsibility of the Institute (in coordination with CONABIO, ECOSUR and CONACYT), are summarized as follows:

| INEGI, ERIS information received and processed | | | | | | | | | |
|--|--------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| Satellite | Sensor | 2008 | | 2009 | | 2010 | | 2011 | |
| | | Received | Processed | Received | Processed | Received | Processed | Received | Processed |
| ERS | LBR | 663 | 663 | 136 | 0 | 716 | 716 | 401 | 401 |
| Landsat 5 | TM | 300 | 40 | 269 | 56 | 234 | 804 | 134 | 219 |
| Terra | MODIS | 361 | 343 | 538 | 277 | 555 | 254 | 115 | 138 |
| AQUA | MODIS | | | | | 76 | 26 | 359 | 121 |
| Total: | | 1,324 | 1,046 | 943 | 333 | 1,581 | 1,800 | 1,009 | 879 |

| INEGI, ERMEXS information received and processed | | | | | | | | | |
|--|--------|----------|-----------|----------|-----------|----------|-----------|----------|-----------|
| Satellite | Sensor | 2008 | | 2009 | | 2010 | | 2011 | |
| | | Received | Processed | Received | Processed | Received | Processed | Received | Processed |
| Spot | 2 | 28,285 | 3,243 | 11,540 | 10,259 | 0 | 26,642 | 0 | 0 |
| Spot | 4 | 26,429 | 3,870 | 18,129 | 13,902 | 18,100 | 47,475 | 4,088 | 3,381 |
| Spot | 5 | 19,317 | 10,097 | 16,176 | 18,739 | 16,019 | 51,816 | 5,575 | 6,144 |
| Total: | | 74,031 | 17,210 | 45,845 | 42,900 | 34,119 | 125,933 | 9,663 | 9,525 |



ERMEXS Antenna Coverage

The ERIS station receives the following signals: Landsat 5 TM, providing about 10 images a week; ERS-2 LBR (radar) supplies about 10 images a week, and TERRA-Modis delivers 3-5 images daily.

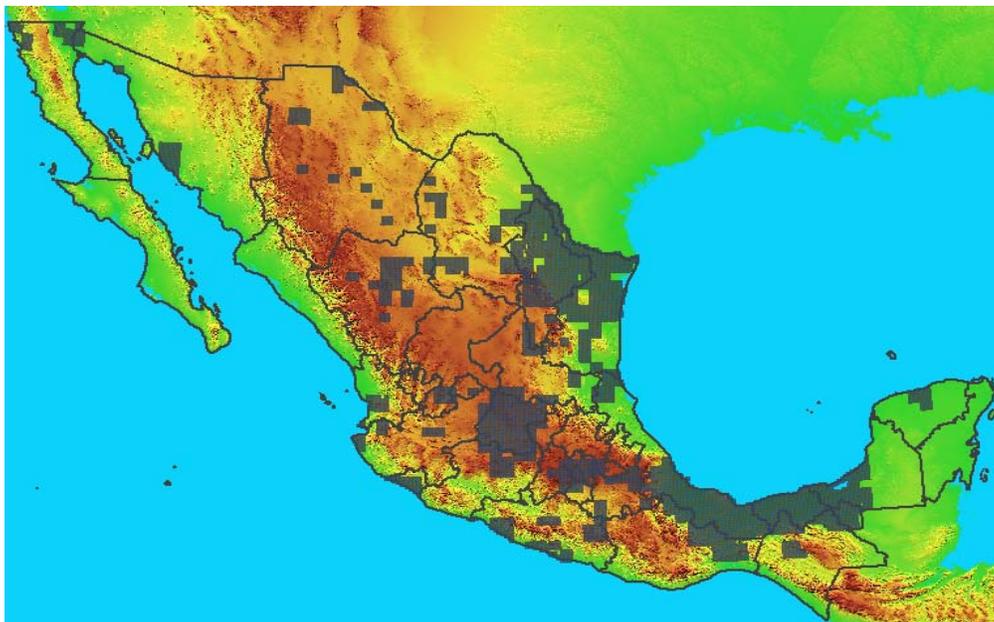
With respect to the virtual station for the acquisition of the GeoEye1 sensor high-resolution images, in December 2010 the Navy arranged for the establishment of such station for image-

capture, with a 5 m space resolution in panchromatic and 2.0 m in multispectral. The station is working since August 2011.

6. Orthophotos

An orthophoto is an image of the terrain, obtained from a photography or a satellite image, that has been orthorectified and transformed and can be used as a map. Its pictorial richness shows all the visible features on the earth surface that have not been affected by the processes of generalization nor representation. It has characteristics of a combined photographic image, with the geometric quality of the cartography; for the previous reasons it is appropriate for the elaboration of photomaps, extraction of vector elements and generation of precise urban cartography.

At present, there is an advancement of 13,400 orthophotos with a 1 m resolution. This production corresponds to the physiography of the North and South plains of the Gulf of Mexico, for the states of Nuevo Leon, Puebla, Guanajuato, Colima, Distrito Federal, Jalisco, Hidalgo, Coahuila, Sonora, Zacatecas, Mexico and the northern part of the state of Tamaulipas, as well as localities with more than 2,500 inhabitants.



Orthophotos availability Scale 1:10,000

CARTOGRAPHIC PRODUCTION

7. Topographic Cartography

The topographic cartography represents the main infrastructures: highway, communication, hydraulic supply and electrical; the names and locations of urban and rural localities; orographic

and hydrographic features; coastline and urban areas, among others. It is compiled with photogrammetric techniques from aerial photographs, geodetic information and field verification.

The scales used are:

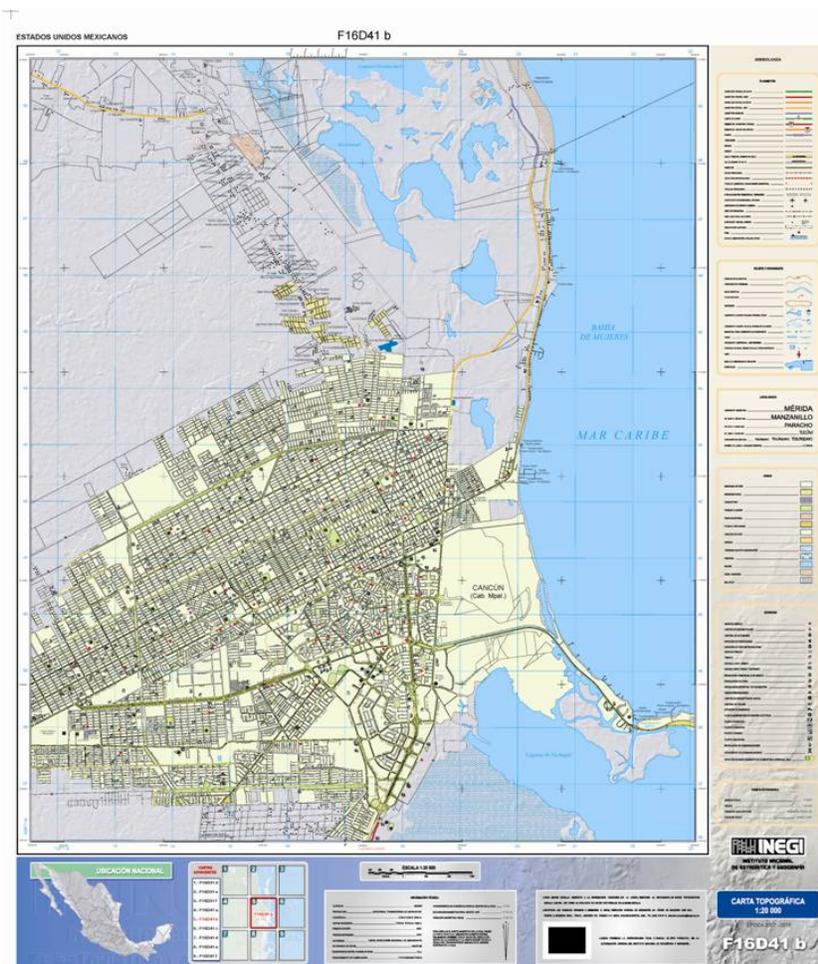
| Scale | Format | Map coverage approx. | Sheet number for national coverage | Coverage advance % | Update |
|-------------|---|-------------------------|------------------------------------|--------------------|-------------|
| 1:20,000 | Regular format of 7'30" latitude × 6'40" longitude, and a 160 km ² approximate coverage. | 166 km ² | 13,400 | 16.81 | 2006 - 2011 |
| 1:50,000 | Regular format of 15'00" latitude × 20'00" longitude, and a 960 km ² approximate coverage. | 960 km ² | 2300 | 97.87 | 1993 - 2004 |
| 1:250,000 | Regular format 1° latitude × 2° longitude, and a 23,000 km ² approximate coverage. | 24,000 km ² | 122 | 100 | 2003 - 2004 |
| 1:1,000,000 | Eleven formats in different sizes, covering the national territory completely. | 250,000 km ² | 8 | 100 | 2001 |

From 2008 to 2011, 2,188 maps have been edited in the following scales:

| Scale | 2008 | 2009 | 2010 | 2011 | Total: |
|-------------|------|------|------|------|--------|
| 1:20,000 | 182 | 500 | 872 | 310 | 1,864 |
| 1:50,000 | 92 | 115 | 12 | 25 | 244 |
| 1:1,000,000 | | | 10 | 1 | 11 |
| Total: | 274 | 615 | 894 | 336 | 2,119 |

There is national coverage for scales 1:50,000 and 1:1,000,000; for the scale 1:20,000 the 1864 formats represent the 13% of the country.

The scale 1:250,000 edition was concluded in 2008, with 121 maps that represent the 100% of the country.



Topographic Map Scale 1:20,000

8. Geostatistical Frame

The Geostatistical Frame is a unique and national system for the georeferentiation of statistical information according to the limits established by the Geographic Frame, which correspond to the boundaries determined by the federal and state governments or, in some cases, are similar to those boundaries, and which are acknowledged by these governments within their respective authority.

The Frame divides the national territory in areas with limits that are identifiable, called "Geostatistical areas" in three levels: State (AGEE, Área geoestadística estatal), Municipality (AGEM, Área geoestadística municipal) and Basic (AGEB, Área geoestadística básica). An AGEB can be either urban or rural. This division facilitates the demarcation of states or municipalities, mainly where the political-administrative boundaries are ill-defined.

Products that make up the Geostatistical Frame:

8.1 Municipality Geostatistical Frame

The Municipality Geostatistical frame includes digital files (in vector format) representing the AGEM, each level with their associated name attributes and geostatistical codes , as well as the spatial representation of the urban locality polygons and rural locality points. Urban localities are those with 2,500 inhabitants or more, or the municipality's capital, even if its population is below 2,500; the rest are considered rural localities.

There are two recent versions: 4.2 and 5.0.

8.1.1 Geostatistical Frame version 4.2

Version 4.2 integrates 32 AGEs, 2,456 AGEMs and 287,727 rural localities inhabited and abandoned (information obtained from the 2009 Economic Censuses).

8.1.2 Geostatistical Frame version 5.0

Version 5.0 integrates 32 AGEs, 2,456 AGEMs, 4,525 urban localities and 187,719 rural localities (information obtained from the planning phase of the 2010 Housing and Population Census).

8.2 Urban Geostatistical Cartography (Planning and Closing of the 2010 Housing and Population Census)

The 4,204 urban localities with cartography updated to the Closing of 2009 Economic Censuses (first half of the year) are included and also organized by State and subsequently by urban locality.

This cartography is formed by urban locality polygons, AGEs and blocks, as well as streets and avenues, basic services and main highways.

8.3 Urban Geostatistical Cartography (Closing of the 2010 Housing and Population Census)

In this cartography 4,525 urban localities organized by State and subsequently by urban locality are included.

The cartography contains street names, main service locations and urban AGE limits with their respective identification codes. 4,525 urban localities, 56,195 AGEs and 1,376,970 blocks are included. About 90% of the 4,525 urban localities is generated from orthophotos, GPS or high resolution images, that is, they are spatially referenced. The other 10% is being processed to give them equal quality.

8.4 Urban Geostatistical Cartography with Human Settlement Demarcation

Graphic digital representation of the Human Settlement polygons in the urban localities of the country; the group of similar homes built in human settlement areas within a town-planning view are considered. There are several types such as: neighborhood, housing development and residential development.

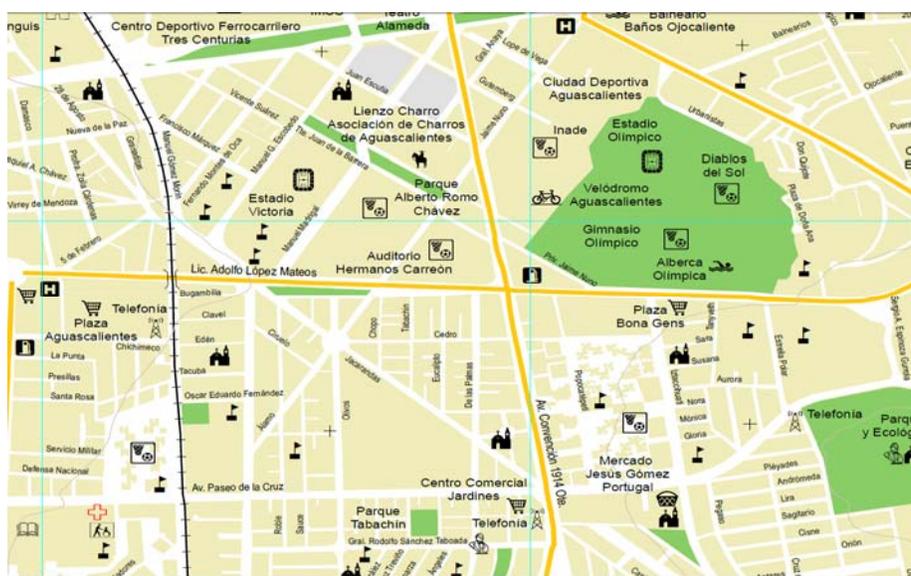
At present, there are 1,929 urban localities with human settlement demarcation.

8.5 Digital Urban Cartography

The General Directorate of Geography and Environment, INEGI, is developing this project in order to provide updated cartographic information of the 2010 housing and population census, using georeferenced digital images and showing the location and distribution of urban properties, the existent infrastructure, streets, avenues and services of the State capital cities of the country, including the Federal District (D.F., Distrito Federal) at division level, and those urban localities with more than 100,000 inhabitants. The purpose is to serve the general user interested in locating showplaces and public services, or as an urban locality guide; also to support decision making of civil and private services projects, as well as research and education projects.

| Scale | Format |
|----------|--|
| 1:10,000 | Regular format of 4'30" latitude × 4'45" longitude, and a 58 km ² approximate coverage. The formats vary with the locality size. |

By December 2011, the project will have 31 State capital cities and the Cuauhtemoc division of the Federal District. Work on a universe of 150 localities is being considered.



Digital Urban Cartography

9. Boundaries

9.1 State Political-Administrative Boundaries

With respect to the territory, cartographic representations are fundamental elements for the definition of administrative boundaries. In this context since 2001 the INEGI has been compiling legal evidences that support the signaling of geographic boundaries between States, and then continue with the representation of this information in cartographic documents.

The advance between 2008 and 2011 is:

The information obtained was integrated in the product Atlas of the Territorial Division; a selection of the legal evidence was performed, which was transcribed into a cartographic base and 32 atlases with information of the inter-municipality political-administrative division by State were generated.

9.2 International Boundaries

Due to the inter-institutional agreement between the INEGI and the Mexican Section of the International Boundary and Water Commission, in 2009 the aerophotographic mosaic of the international boundary demarcation between Mexico and United States, in the area of the Rio Grande, was produced. Composed by 112 orthophotomaps scale 1:25,000- This mosaic represents the international boundary between the City of Juarez, Chihuahua and the Gulf of Mexico, based on the "Treaty to resolve pending boundary differences and maintain the Rio Grande and Colorado River as the International Boundary" signed in Mexico City on November 23, 1970.

Map of the International Boundary on the Rio Grande



10. Cadastre Information

10.1 BANOBRAS¹

The Cadastral Modernization **Program** is jointly performed by the Social Development Ministry, INEGI and other Federal agencies to support the municipality cadastres. Its main objectives are to promote the development of the municipality geographic information systems, to generate reliable information for the development and land administration of the municipality's plan, and to increase the municipality's income. By December 31, 2009, the application and elaboration of the diagnosis and action plan for 48 municipalities were performed, as well as 17 executive projects, giving service to 35 municipalities.

10.2 INDAABIN²

This component of the cadastre information consists on performing topographic surveys of federal property buildings and producing their respective plans. From 2007 to 2010, 877 properties were surveyed and 17,775 federal properties were georeferenced.

| Year | Properties surveyed | Federal Properties georeferenced |
|-----------|---------------------|----------------------------------|
| 2007-2008 | 541 | 0 |
| 2009 | 110 | 2,500 |
| 2010 | 226 | 15,255 |

10.3 ASERCA3-SIAP⁴-INEGI

Within the agreement for the "Updating of Data and Files Directory of the Program for Direct Support to the Field (PROCAMPO)", 724,656 properties have been georeferenced and 422,185 owners have been served during the period 2009-2010.

¹ **National Bank of Public Works and Services.** Development bank classified as a public corporation with majority State participation, of which aim is to finance or re-finance public or private investment projects for infrastructure and public services, as well as to contribute to the institutional strengthening of the federal, state and municipality governments.

² **Institute of National Properties Management and Valuation.** It is a deconcentrated agency of the Secretariat of the Civil Service, of which aim is to provide property, valuation, legal, regulatory and registration services to the Public Administration, collaborating to the social and economic development of Mexico.

³ **Support and Services to the Agricultural and Livestock Marketing.** Administrative deconcentrated agency of the Secretariat of Agriculture, Livestock, Rural Development, Fisheries and Food (SAGARPA, Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación), of which aim is to design, implement, follow up on and evaluate the public policies on support to the Field included in the National Development Plan, as well as in the mid-term Sector Program, in order to strengthen the sector development, agriculture profitability and national producers income.

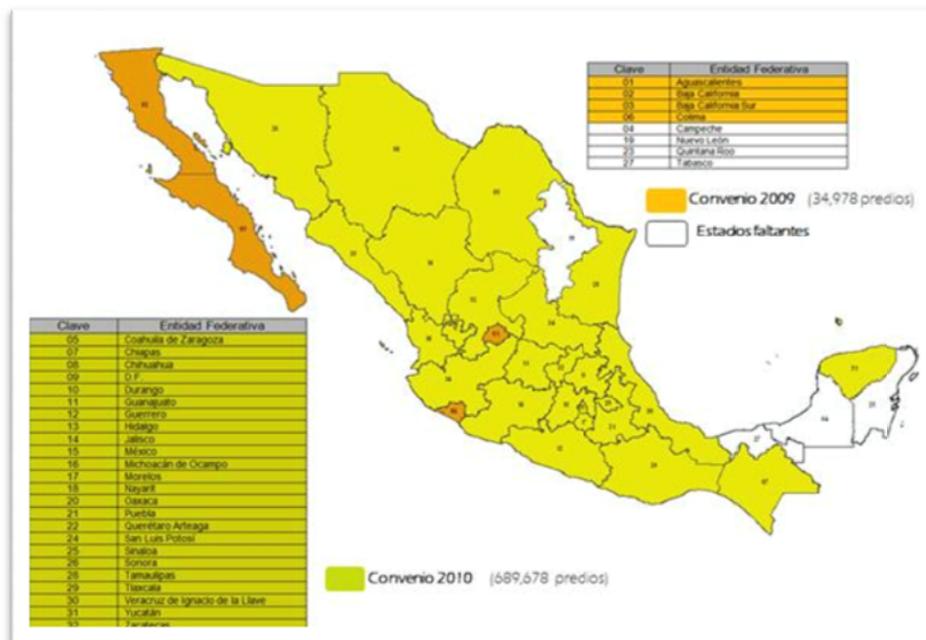
⁴ **Agrifood and Fishery Information Service.** Deconcentrated agency of the SAGARPA, in charge of the design and coordination of the National Information System of the Agrifood and Fishery sector, as well as the fostering of the assistance and coordination for the implementation of the Information National System for Rural Sustainable Development.



Data and Dossier updating of PROCAMPO Directory

Advancement per Agreement:

| Agreement 2009 | Agreement 2010 |
|---|--|
| 34,978 georeferenced properties of 25,222 owners in 4 States. | 689,678 georeferenced properties of 396,963 owners in 28 States. |



Advancement from 2009 to 2010

11. Natural Resources

There is a great diversity and richness of natural resources in the country. This diversity is due to its complex topography and geology, as well as to historical-evolutionary aspects.

At present, the General Directorate of Geography and Environment has generated the following cartographic information on edaphology, land use, potential land use, hydrology and climatology:

| Map | Description |
|---|---|
| Edaphological Map 1:250,000 Series II, 2005 to 2009 | This cartography represents the morphological, physical and chemical characteristics of the national soils. It is considered as a reference frame for ecological disasters and environmental degradation prevention, caused by soil over-exploitation or inadequate use. This theme has the national coverage corresponding to the Series II ⁵ distributed in 153 sets up to 2009. |
| Surface Hydrology Map 1:250,000 Series II, 2001 a 2011 | This map contains Information of the hydrologic basins of the country: hydrographic network, hydrometric station, dams and body water location, signaling the use given to this resource, and the irrigation districts location supplied by the surface exploitation. The Series III is in process. |
| Groundwater Hydrology Map 1:250,000 Series II, 1994 | The map provides information about the probable existence of groundwater aquifers, inferred from the characteristics of the lithological material and the terrain configuration; it also indicates well, waterwheel and aeroengines location with phreatic levels (depth to the water); the quantity of water being extracted and its use; thermal springs location with water temperature; thermoelectrical facilities locations, and irrigation districts supplied by groundwater exploitation. The Series III is being produced. |
| Land Use and Vegetation Map 1:250,000 Series IV, 2006 - 2010 | This map shows the distribution of the natural vegetation variety, as well as the level and kind of vegetal community damage and its dynamic in Mexico; besides it allows to learn about the location of agriculture areas along with their water availability and cultivation stay in the field. The distribution of the vegetal cover and different land uses are represented at all scales according to the INEGI Vegetation Classification System. The series V is in process. |

| Map | Description |
|------------------------|--|
| Potential Land Use Map | <p>The map describes the environmental condition set for a better soil and resources exploitation for the agriculture, livestock, forestry and urban development.</p> <p>There are 107 maps produced and 32 printed according to the 1982 methodology. The corresponding processes to apply 2010 methodology have begun. So far, 7 sets have been concluded and 5 are in process.</p> |
| Climate Cartography | <p>This map provides information about the climatic characteristics of the national territory.</p> <p>It includes the same reference frames as the topographic map. In the series 1:500,000 all the climates of the country are shown.</p> <p>The Series 1:1,000,000 is composed of three climate maps, including the cartographic expression of the drought, that is, the period of the rain season when the rainfall decreases, and the records of the meteorological stations referring to the temperature are established.</p> |



Thematic Cartography

⁵Series: Set of maps that have continuity in data and theme.

The advancements in the above mentioned maps are shown in the following table:

| Project | Scale | 2008 | 2009 | 2010 | 2011 |
|---|--------------|-------------|-------------|-------------|-------------|
| Edaphology Series II | 1:250,000 | 63 | 8 | | |
| Surface Hydrology Series II | 1: 250,000 | 9 | 8 | 17 | 17 |
| Groundwater Hydrology Series II | 1: 250,000 | 11 | 6 | | |
| Groundwater Hydrology Series III | 1: 250,000 | 1 | 9 | 16 | 9 |
| Land Use and Vegetation | 1:50,000 | | | 220 | 129 |
| Land Use and Vegetation Series IV | 1:250,000 | 57 | 148 | | |
| Potential Land Use | 1:250,000 | | | 6 | 5 |
| Climate Information | 1:1,000,000 | 2 | 6 | | 1 |
| Geology Series II | 1: 50,000 | | | 18 | 5 |
| Information Generation Scale 1:250,000 Erosion (new stage for the edaphological information) | 1: 250,000 | | | 34 | 40 |
| Bathymetry | 1:1,000,000 | 3 | 2 | 2 | 2 |
| EEZ Bathymetry | 1:1,000,000 | 5 | 2 | 1 | |

The Edaphology series II, Surface and Groundwater Hydrology Series II, and Land Use and Vegetation Series IV have national coverage, therefore no later activities are shown. For each case, the methodologies are developed and adapted for the next series. With respect to Edaphology, new land erosion information is being generated. With respect to Climate information, the methodology was developed for a new version of climate type map during 2009 and 2010. As for the EEZ Bathymetry, the national coverage was concluded in 2010 while in 2011 the updating of the Bathymetric Data Dictionary was begun as a second version in March 2011.

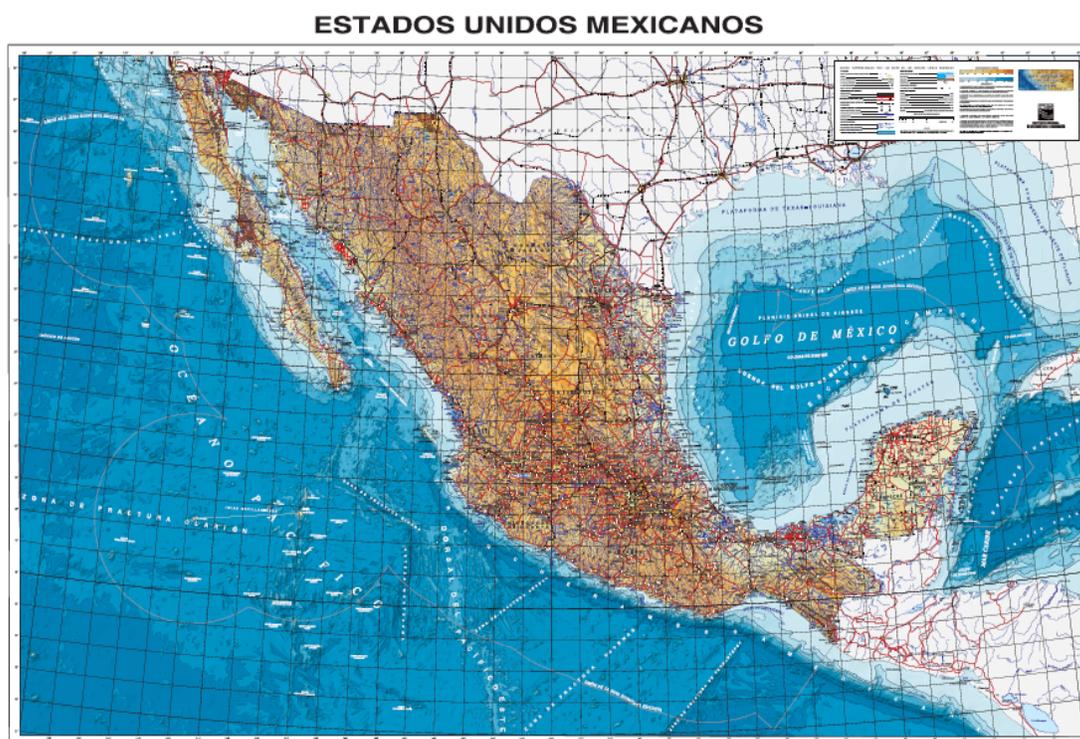
12. State Summaries

The State Summaries are publications that integrate information on infrastructure, orography, hydrography and towns of the country; produced from the topographic map scale 1:250,000.

In them, heights are represented by colors and the orographic features on the terrain are shaded. Hydrological and civil works, land, aerial and maritime communication routes, and towns information is included. The product has been completely finished for the 32 States, in scales that vary for each state from 1:80,000 to 1:250,000.

13. Map of the Mexican Republic

The Map of the Mexican Republic represents heights and orographic features and it includes those hydrological and civil works, and land, aerial and maritime communication routes that are feasible to be represented at each of the scales. In some scales the sea demarcation is shown.



Map of the Mexican Republic

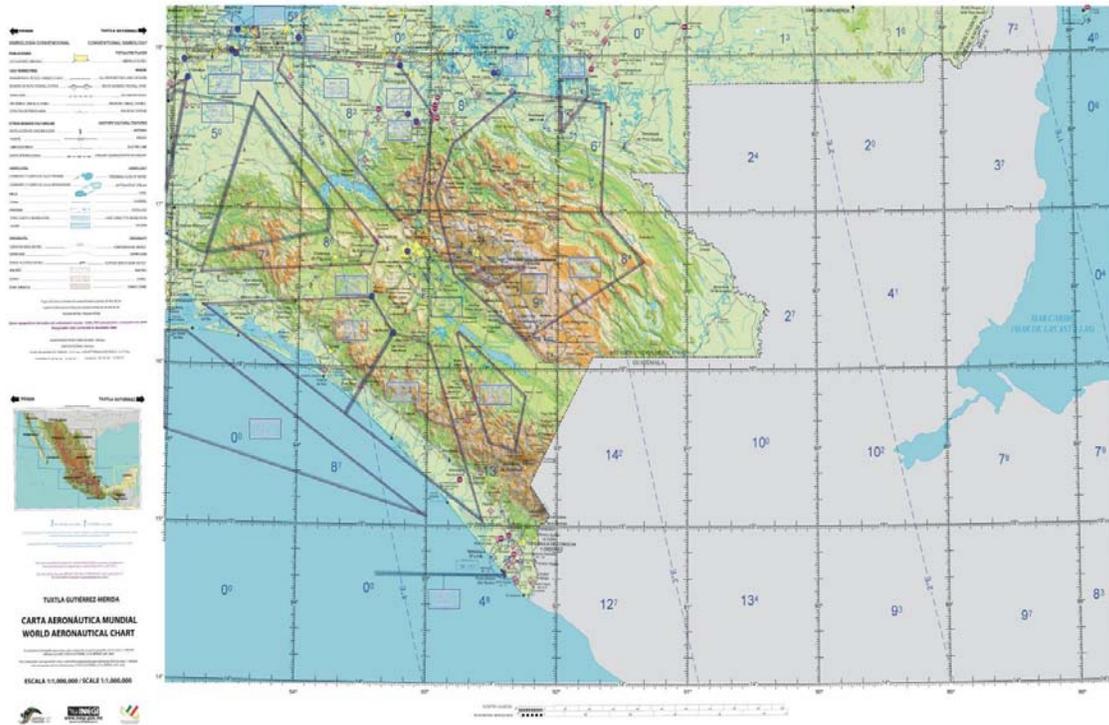
14. Aeronautical Chart

The Aeronautical Chart provides information that complies with the need of aerial visual navigation in flights at low speed, short and medium distances and low and medium altitudes.

The aeronautical chart 1:1,000,000 is available in a six-chart series with information on both sides, covering all the territory.

The information is provided by the Mexican Airspace Navigation Services, Direction General of Civil Aeronautics, Labor Union Association of Aviators and Direction General of Merchant Navy, through the Direction General of Planning, Secretary of Communications and Transport.

The Secretary of National Defense provides the information about military aerodromes and restricted zones for commercial flights.



World Aeronautical Chart Scale 1:1,000,000

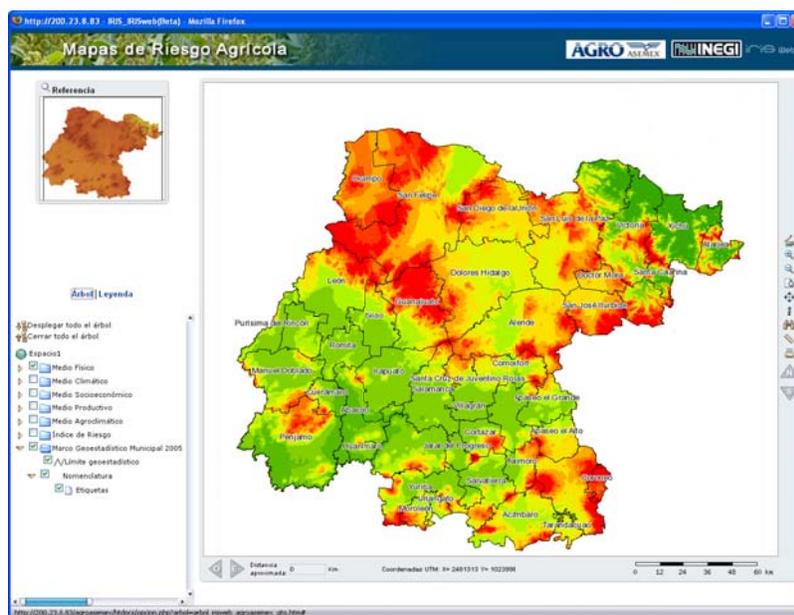
OTHER PRODUCTS

15. Geomatic Solutions

During the period 2008-2011, the following geomatic solutions have been generated:

15.1 IRIS WEB AGROASEMEX version 1.0

Web-based Information System on Agricultural Risks that allows to graphically find the probability of a loss associated to climate threats, through query tools and information analysis. The information included in the system offers analysis elements to the participants of the agriculture sector and shows information at the municipality level divided into different themes: physical, climate, socio-economic and productive environments, as well as risk indexes.



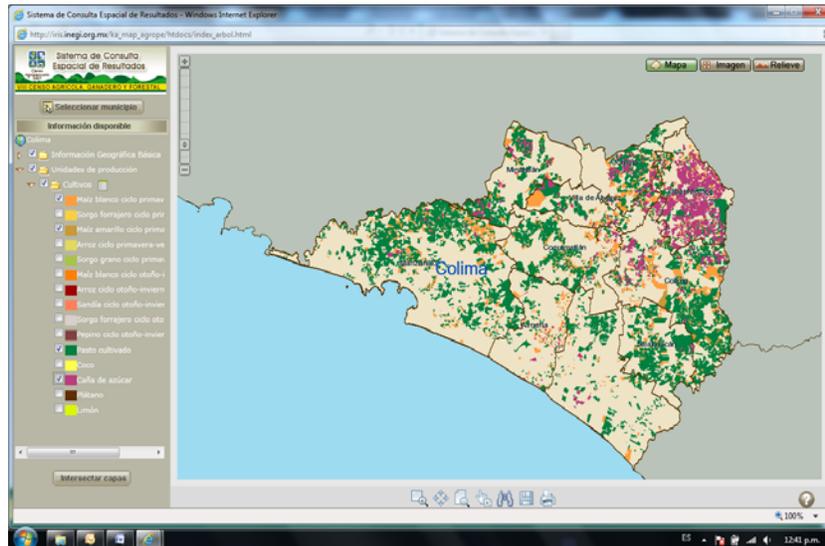
IRIS WEB AGROASEMEX version 1.0 (Agriculture Risk Map)

15.2 Belize Cartography for the Censuses

The *Belize Cartography* Project requested by the Statistical Institute of Belize (SIB) consists in the digital extraction of the cartographic information from orthorectified satellite images using an application of a geographic information system. The cartography delivered was used as support for the activities of planning, implementation, processing and dissemination of Belize's 2010 Housing and Population Census results. It contains polygon-like cartography: locality polygons, enumeration districts, blocks, homes, water bodies; line-like cartography: coastlines, street centerlines, highways, roads, ways and point-like cartography (docks and bridges). It was prepared for the urban areas of Belize, Benque Viejo, Corozal, Dangringa, Orange Walk, Punta Gorda, Santa Elena, San Ignacio and San Pedro, and the rural areas of the districts of Corozal, Orange, Belize, Cayo, Stann Creek and Toledo.

15.3 Spatial Query System for the 2007 Agriculture and Livestock Census Results

The Spatial Query System for the 2007 Agriculture and Livestock Census Results is used as a means for the dissemination of the Census data. It is organized in 32 projects, one per State and contains query and information analysis tools. It is widely used by several sectors of society since it allows the user to see the data captured by the Institute during the Census, as well as to analyze information in order to support decision making. The system has statistical and geographical information derived from the 2007 Agriculture and Livestock Census which covers diverse themes such as tenancy type, agriculture, livestock and forestry activity, water availability, technologies, equipment, etc., as well as environmental aspects, urban and rural localities and communications and transport infrastructure.



Spatial Query System for the 2007 Agriculture and Livestock Census Results

15.4 Implementation of the Digital Map of Mexico version 5.0

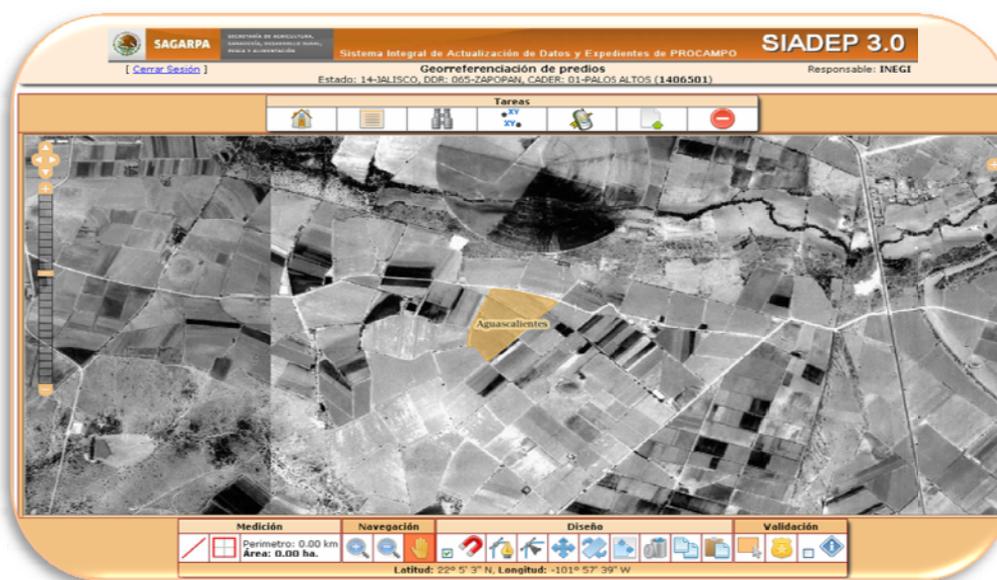
Web geographic information system with capacities such as simple visualization of geographic layers to spatial analysis, it can also be used as a platform to generate solutions that combine geographic and statistical data. It contains the following layers: topographic information, natural resources, geostatistical frame to the block and street number level, social property cadastre, geodetic network and orthophotos, among others; besides it allows to associate statistical information to geographic objects of the geostatistical frame.



Digital Map of Mexico

15.5 Development, Implementation and Maintenance of the Integral System for the Updating of PROCAMPO Dossiers

The INEGI is participating in an agreement with ASERCA, of which activities consist on the development of the different modules of the Integral System for the Updating of the PROCAMPO Dossiers. This system works on a web platform over a server for each Support Center for the Rural Development of SAGARPA⁶. The system contains property data records supported and updated by PROCAMPO; digital dossiers with the files produced by the digitation of the documents delivered by the owners, as well as the approximate property georeference, geographic and topographic layers, and also layers from the Program for the Certification of Rural Property Rights and Entitlement of Urban lots.



Integral System for the Updating of PROCAMPO Documents and Dossiers

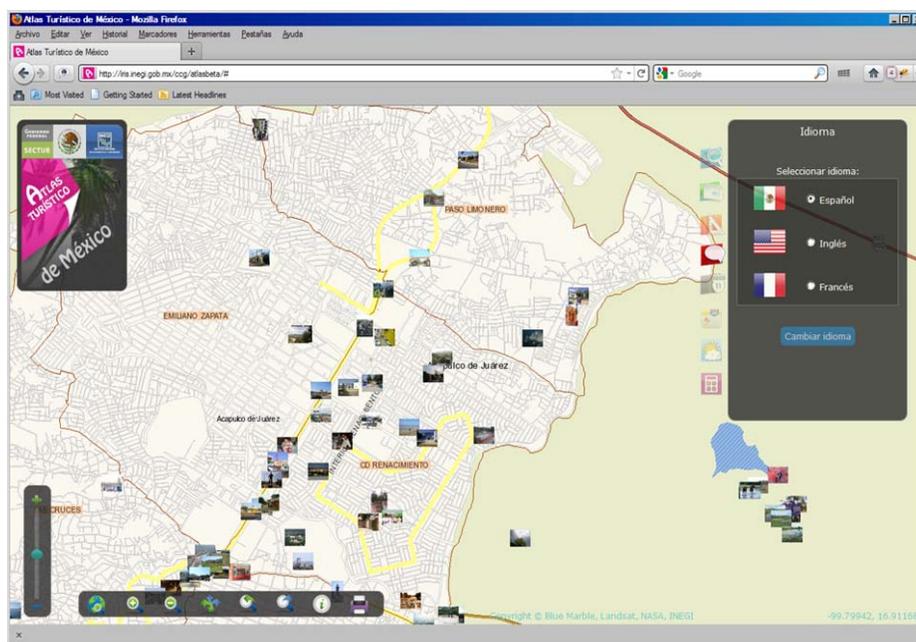
15.6 Hydrographic Network obtained from Topographic Vector Data scale 1:50,000

The Hydrographic Network provides vector information with geometric network topology. Flow lines are classified by two methods according to their hydromorphometry and it also includes the capture units of the digitized surfacewaters features and the corresponding with the same scales of the network, to be used in diverse projects related to the study of hydrographic basins. It contains flow lines, drainage points and sub-basin polygons that model the surface runoffs.

⁶ **Secretary of Agriculture, Livestock, Rural Development, Fisheries and Food.** Agency of the Federal Executive Power of which objectives are the practice of a support policy that allow a better production, make the most of comparative advantages of our agricultural and livestock sector, integrate the rural environment activities to the productive chains of the economy and encourage the collaboration of the producer organizations with programs and projects of their own, as well as the goals and objectives proposed for the sector within the National Development Plan.

15.7 Tourist Atlas of Mexico

The Tourist Atlas of Mexico is a software application developed in a web platform for tourism promotion in Mexico to help the user to find the sites of tourist interest, with basic information on how to get from one site to another; map navigation with zooming in and out, up-down-right-left displacements, relevant guiding data and other information about the elements provided in the system. It contains the 2009 national, state and municipality geostatistical frame; the 2009 territorial integration; the 2009 locality limits and blocks; street, sites and magic towns names; tourist, archeological and economic zones; communication infrastructure and hydrography scale 1:50,000; all of Mexico's tourist units with H (National Program of Hygienic Food Handling) and M (Program of Quality Modernizes) symbols; Micro, Small and Medium Companies (MIPYMES, Micro, Pequeñas y Medianas Empresas); Tourist MIPYMES; "Tourism for Business Meetings"; the 10 tourist routes of Mexico, and nautical, sport, cultural, health and nature Tourism.



Tourist Atlas of Mexico

15.8 National Statistical Directory of Economic Units (DENUE)

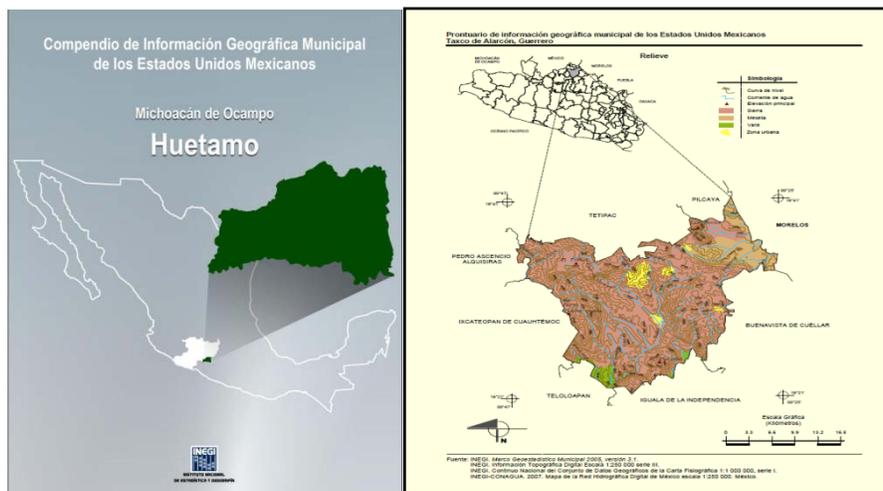
The [National Statistical Directory of Economic Units](#) Web query system is based on the Digital Map of Mexico and allows the user to see more than 4.3 millions of economic units georeferenced all around the country, grouped by economic activity according to the North American Industry Classification System (NAICS). This tool allows selecting economic units by geographic area, number of employees, economic activity and other specific characteristics.



National Statistical Directory of Economic Units

15.9 Municipality Geographic Information Compendia

The Municipality Geographic Information Compendia is a digital publication whose general objective is to integrate and disseminate the relevant information about natural resources and environment, transport infrastructure and geographic location of 2,456 Mexican municipalities and their localities. It is available for free download free from the INEGI website.



Municipality Geographic Information Compendium of the State of Michoacán de Ocampo

16. Geographic Indicators

Due to the commitments established by the LSNIEG, 19 indicator proposals aligned with the Millennium Development Goals were elaborated.

- Coastal aquifer with saline intrusion.
- Prohibited areas for the free extraction of groundwater with respect to the total surface of the territory.
- Concession volume for consumptive use.
- Wastewater treatment.
- Degree of pressure on hydrological resources.
- Intensity of groundwater use (IUAS, Intensidad de uso del agua subterránea).
- Water quality.
- Surface affected by soil degradation in Mexico.
- Remaining natural vegetation surface change per main vegetation types.
- Protected and under sustainable management surface.
- Surface under forestry management.
- Consumption of ozone depleting substances.
- Air quality: days when the standard values are exceeded.
- Air quality: air quality monitoring in metropolitan zones or relevant cities.
- Emissions of greenhouse gases.
- Proportion of species in danger of extinction.
- Hazardous waste handling: installed capacity authorized.
- Uncontrolled disposition of urban solid waste (RSUSC, Residuos sólidos urbanos dispuestos sin control).
- Coastal municipality population in the analysis process for approval.

17. Regulations

Within the SNIEG context and as one of the General Directorate of Geography and Environment commitments with respect to geographic and environmental technical regulations, 28 technical standards are being developed; the following standards are published in the Official Bulletin of the Federation (DOF, Diario Oficial de la Federación): Technical Standard for the National Geodetic System, Technical Standard for the Geographic Metadata Generation, Technical Standard for the Positioning Accuracy Standards and Technical Standard on Geographic Addresses.

18. National Registry of Geographical Information (RNIG)

With the enactment of the LSNIEG, the activities for coordinating the generation and consolidation of the [National Registry of Geographical Information \(RNIG\)](#) have been strengthened, with INEGI as the coordinator of the System and operator of the National Registries.

The RNIG's objective is to document, register and spread the existent geographic information of national interest in order to rule its generation, as well as to strengthen its safeguard and availability. The RNIG has three main components: 1° The Units of the State that are in charge of developing geographic activities; 2° Data, data groups and products generated by the Units of the State, and 3° Data, Dataset and Product attributes.

The information included in the RNIG comes from the metadata mainly, some of the advancements achieved may be found at the INEGI website.

19. Strategic Alliances

The INEGI has fortified its participation in international forums joining as a member in the following international organizations:

- International Cartographic Association (ICA)
- International Society for Photogrammetry and Remote Sensing (ISPRS)
- United Nations Regional Cartographic Conference for the Americas (UNRCCA)
- Permanent Committee for Geospatial Data Infrastructure of the Americas (CP-IDEA)
- International Federation of Surveyors (FIG)

As well, we continue collaborating with the following international organizations:

- European Committee Responsible for Official Cartography Agencies (CERCO)
- Pan American Institute of Geography and History (PAIGH)
- United Nations Program for Environment (UNEP)
- International Steering Committee for Global Mapping (ISCGM)

Groups of Experts:

- Working Group on Environmental Statistics of the Statistical Conference of the Americas (CEA-CEPAL)
- Oslo Group on Energy Statistics of the United Nations (Oslo Group)
- United Nations Group of Experts on Geographical Names (UNGEGN)
- Expert Group on the revision of the Framework for the Development of Environment Statistics

20. International Agreements

These are the current international agreements:

- PUBLIC CARTOGRAPHIC COMPANY OF THE CANARIES (GRAFCAN)
- NATIONAL GEOGRAPHIC INSTITUTE, FRANCE (IGN)

- UNITED STATES GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR (USGS)
- LATIN AMERICAN INSTITUTE OF THE EDUCATIONAL COMMUNICATION (ILCE)
- NATIONAL INSTITUTE OF STATISTICS OF GUATEMALA (INE)
- NEW BRUNSWICK UNIVERSITY, CANADA
- NORTH AMERICAN CENTER OF ENVIRONMENTAL INFORMATION AND COMMUNICATION, MEXICO
- GOVERNMENT OF THE REPUBLIC OF GUATEMALA