Applying Geospatial Tools to Produce Data for SDG Indicators in Mexico

Inter-Agency and Expert Group On SDGs Indicators

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Background

- **INEGI** has produced Geospatia Data about the Natural Resources of Mexico for several decades.
  - Soil: 3 versions, using International Soil Classifications Systems
  - Geology
  - Water: surface and groundwater
  - Land Use and Vegetation: 6 versions.
  - National Datasets, 1:250,000 scale

15.1.1 Forest area as a proportion of total land area

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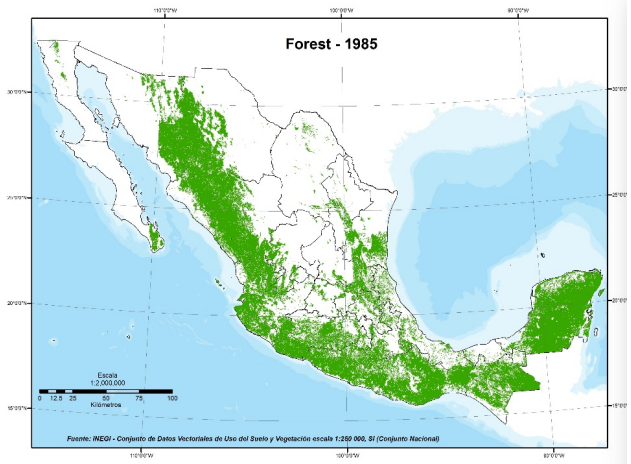
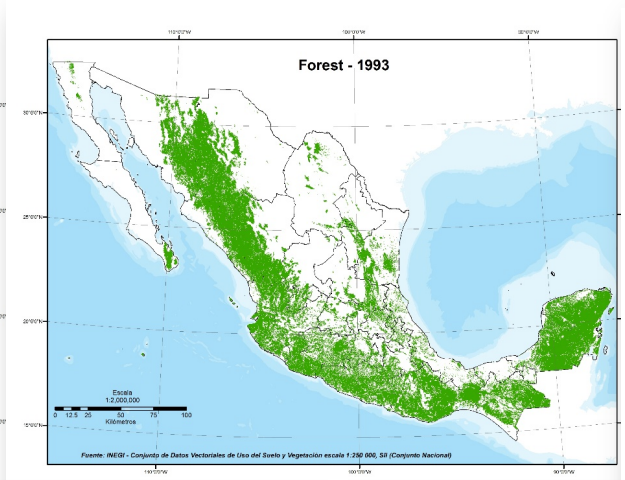
Target 15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements.

- 15.1.1 Forest area as a proportion of total land area
  - This target can be derived totally from geospatial information.
  - Five map series of Vegetation and Land Use have been developed for Mexico
  - 57 Vegetation types, including Temperate Forests, Tropical Forests, Grasslands, Shrub-lands, Mangroves and others.
  - Other categories: Agricultural land, urban – buildup areas.

Results

Forest area as a proportion of total land area.				
1985	1993	2002	2007	2011
36.8%	35.4%	34.5%	34.1%	33.7%


Forest - 1985
Escala
1:2,000,000
0 12.5 25 50 75 100
Kilómetros
Fuente: INEGI - Conjunto de Datos Vectoriales de Uso del Suelo y Vegetación escala 1:250 000, SI (Conjunto Nacional)


Forest - 1993
Escala
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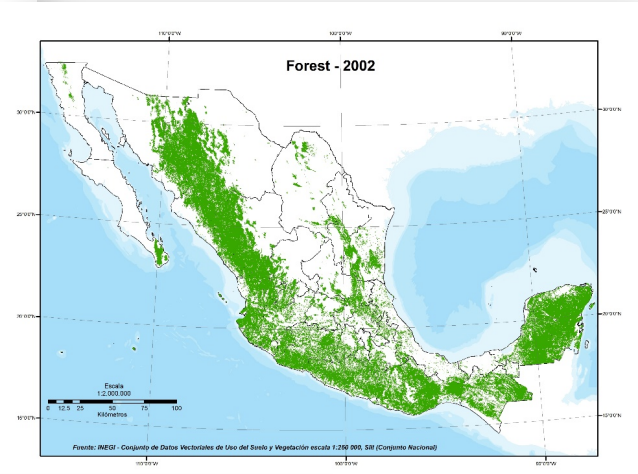
0 12.5 25 50 75 100
Kilómetros
Fuente: INEGI - Conjunto de Datos Vectoriales de Uso del Suelo y Vegetación escala 1:250 000, SII (Conjunto Nacional)


Forest - 2002
Escala
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Kilómetros
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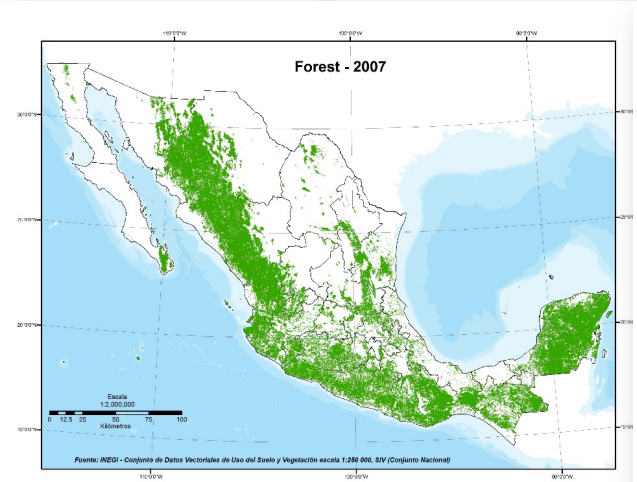
Forest - 2007
Escala
1:2,000,000
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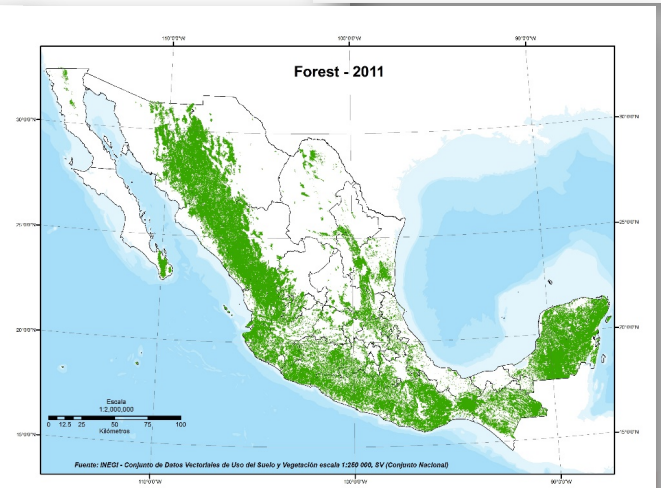
Kilómetros
Fuente: INEGI - Conjunto de Datos Vectoriales de Uso del Suelo y Vegetación escala 1:250 000, SIV (Conjunto Nacional)


Forest - 2011
Escala
1:2,000,000
0 12.5 25 50 75 100
Kilómetros
Fuente: INEGI - Conjunto de Datos Vectoriales de Uso del Suelo y Vegetación escala 1:250 000, SV (Conjunto Nacional)

INDICATOR 9.1.1

Proportion of the rural population who live within 2km of an all-season road

Tier III

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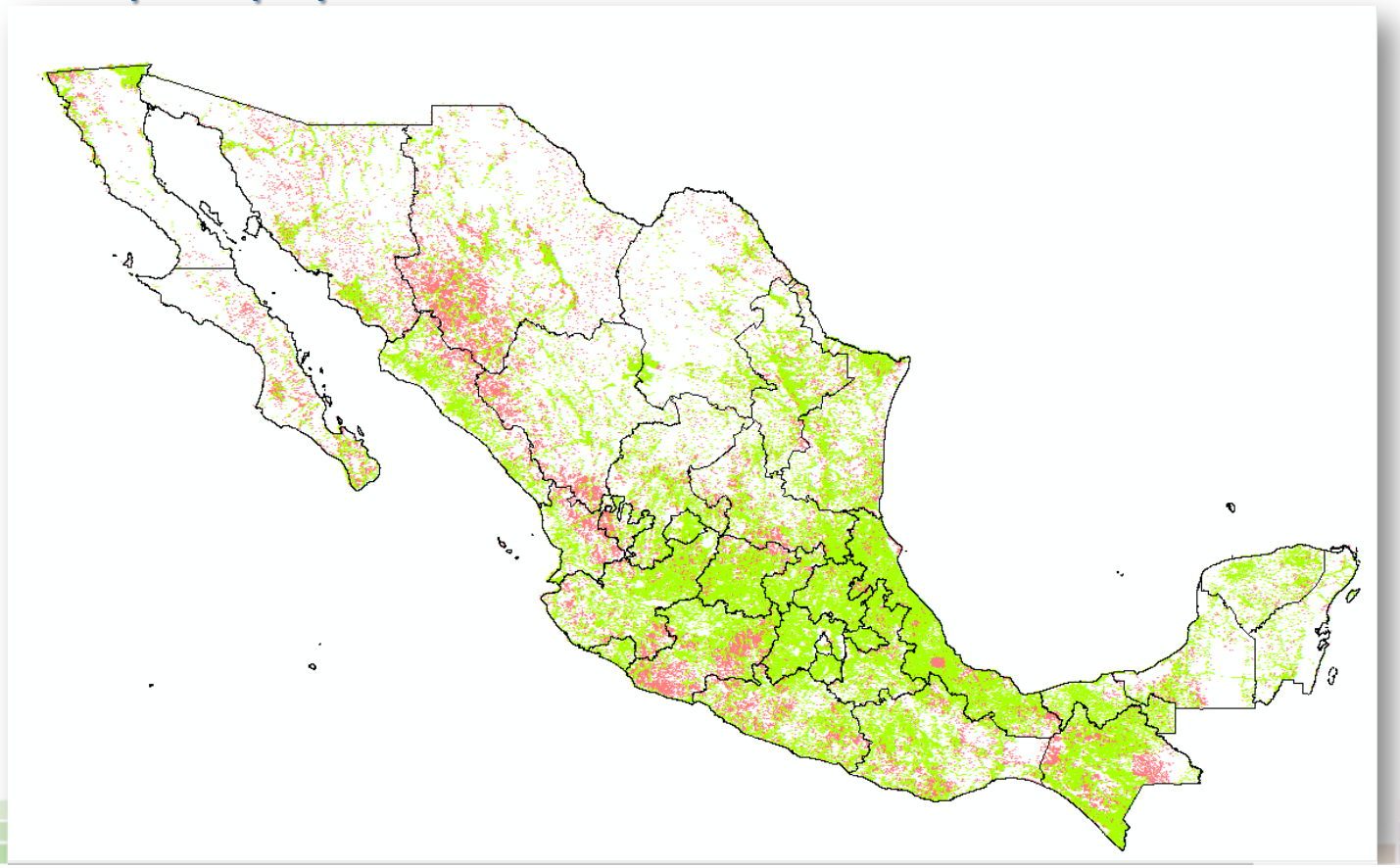
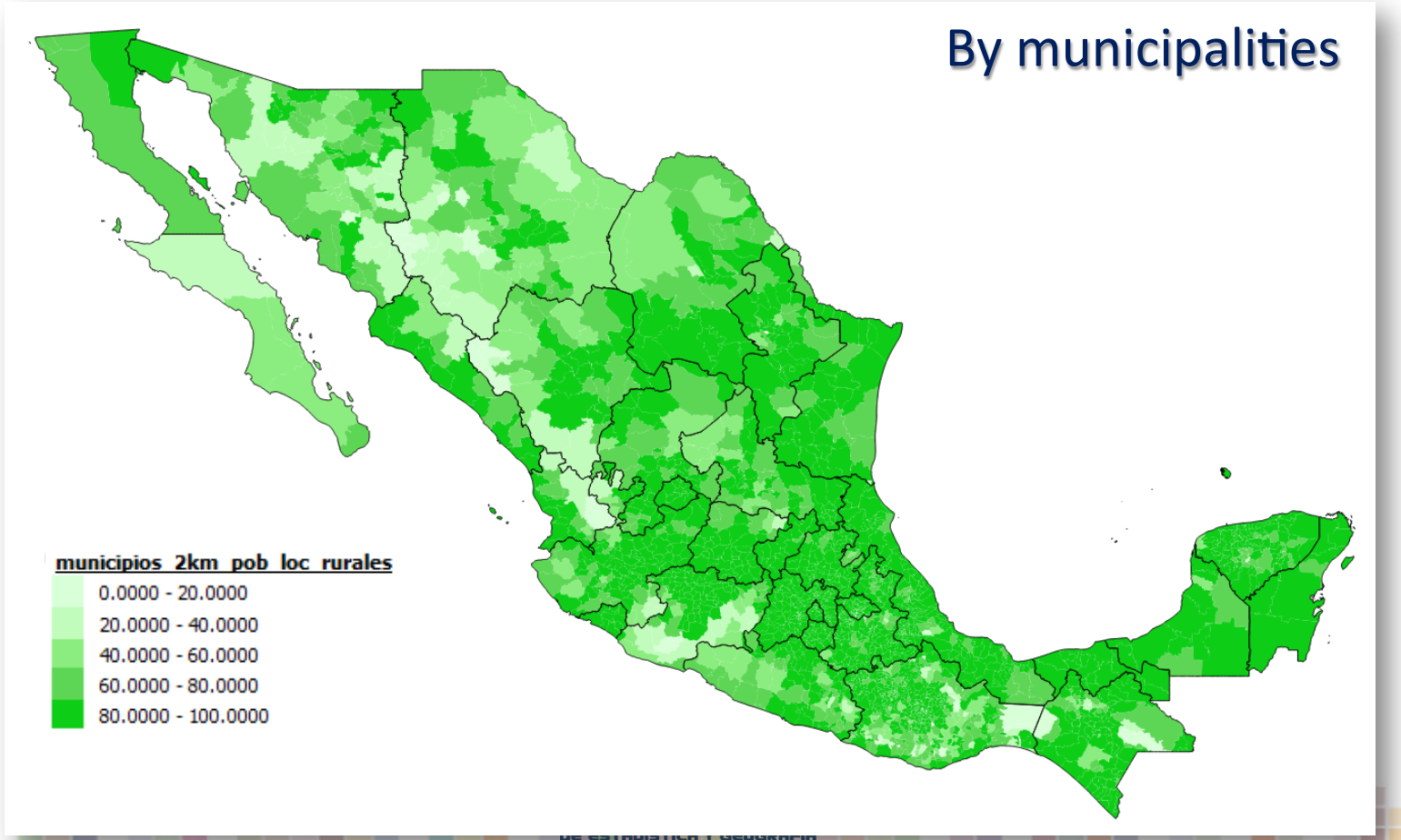
Target 9.1 Develop quality, reliable, sustainable and resilient infrastructure, to support economic development and human well-being with a focus on affordable and equitable access for all.

- 9.1.1 Proportion of the rural population who live within 2km of an all-season road.
  - Statistical data: Census Data for each population center, with total population, and other census variables, and longitude, latitude for geospatial purposes (192,244 localities).
    - Select populated localities with 2,500 and less inhabitants as rural.
  - Geospatial data: National Topographic Data Set 1:50,000.
    - Transportation Layer.
    - Paved highways and gravel roads as all season roads.

Output: Green pop localities within 2km of road, pink pop localities not within the 2km buffer.



By municipalities



Obtain total population for each class (within 2km, farther than 2km)

- National
- State
- Municipality

Rural population within 2Km of an all season road (National, and State)			
State	Rural population within 2km of road	Total Rural Population	Proportion (as %) of population within 2km of road
National	24,259,295	26,059,128	**93.1**
Aguascalientes	228,934	229,907	**99.6**
Baja California	219,355	243,196	**90.2**
Baja California Sur	73,469	88,308	**83.2**
Campeche	196,571	209,032	**94.0**
Coahuila	260,790	275,003	**94.8**
Colima	72,540	73,016	**99.3**
Chiapas	2,131,638	2,459,382	**86.7**
Chihuahua	366,551	517,269	**70.9**
Ciudad de México	40,687	40,687	**100.0**
Durango	427,687	508,499	**84.1**
Guanajuato	1,590,087	1,653,668	**96.2**
Guerrero	1,259,310	1,416,920	**88.9**
Hidalgo	1,247,993	1,273,778	**98.0**
Jalisco	926,187	985,248	**94.0**
México	1,956,414	1,976,017	**99.0**
Michoacán	1,246,190	1,362,688	**91.5**
Morelos	285,369	286,889	**99.5**
Nayarit	297,297	336,945	**88.2**
Nuevo León	239,483	247,333	**96.8**
Oaxaca	1,737,581	2,002,757	**86.8**
Puebla	1,563,986	1,633,943	**95.7**
Quérétaro	527,405	540,664	**97.5**
Quintana Roo	152,584	157,058	**97.2**
San Luis Potosí	872,814	935,008	**93.3**
Sinaloa	702,073	751,994	**93.4**
Sonora	320,686	372,252	**86.1**
Tabasco	943,984	954,075	**98.9**
Tamaulipas	386,563	398,945	**96.9**
Tlaxcala	232,159	235,696	**98.5**
Veracruz	2,866,657	2,976,060	**96.3**
Yucatán	310,569	312,821	**99.3**
Zacatecas	577,965	604,070	**95.7**

Mexico's Open Data Cube project

- **INEGI** has initiated a face-to-face collaboration with **Geoscience Australia** to detail a local implementation of a Data-cube in Mexico

- **Objective**
  - ✓ Implement Open Data Cube's open source technology, and adopt it in INEGI's processes related to satellite images
    - ➢ The technology includes a platform for the storage, organization, management and analysis of satellite images

Expected benefits

- ✓ Exploitation of the true potential of satellite images
- ✓ Promote more timely and accessible information
- ✓ More varied Geospatial and Statistical data about Natural Resources and the Environment
- ✓ Encourage exchange of data analysis methodologies

Mexico's Open Data Cube project

Forests

15.3.1 Proportion of land that is degraded over total land area (II)

Farming

2.4.1 Proportion of agricultural area under productive and sustainable agriculture (III)

Wetlands

6.6.1 Change in the extent of water-related ecosystems over time (II)

Urban growth

11.3.1 Ratio of land consumption rate to population growth rate (II)

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Open Data Cube applications underway at Geoscience Australia

WOFS, Water observation from space: % of time that a pixel is covered with water:

- Permanent water bodies
- Flooded areas, water bodies during the rainy season, seasonal water bodies
- New dams.

Land cover change:

- Fractional cover
- Normalized Difference Vegetation Index
- Urban Growth

Advantages when implementing an Open Data Cube:

- Massive storage, processing and analysis of satellite images.
- It enables the use of Big Data and Machine Learning to generate spatial data on Natural Resources.
- Produce data with greater spatial detail; frequent updates.
- Improvement of line products: Use of Soil and Vegetation
- Development of new products: monitoring of water bodies, National Image Mosaics.

Challenges and opportunities

- Growing availability of Remote Sensing data
- Technologic progress:
  - Big Data.
  - More processing power
  - Machine Learning

Thank you!