



NATIONAL AUTONOMOUS UNIVERSITY OF MEXICO



SPATIAL DATA INFRASTRUCTURE PART_I

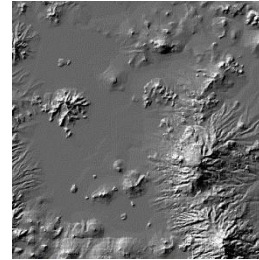
Dr. Jorge Prado Molina

Geography Institute, UNAM.



CONTENTS

- Introduction
- Geographic Information (GI)
- Geographic Information Systems (GIS)
- What is an Spatial Data Infrastructure (SDI)?
- Significance of GI, GIS and SDI in decision making processes
- Components of an Spatial Data Infrastructure



CONTENTS

Primary components to establish an SDI:

- Institutional arrangements
- Framework data
- Policies.
- Standards
- Technologies



CONTENTS

SDI Organization:

- Institutional arrangements
- SDI development model (mandatory or voluntary)
- Partnership
- Authoritative data sources
- Governance
- Board of directors
- COMMITTEES



CONTENTS

Components of an SDI.

- Resources: data bases, maps, servers, and other available data.
- Metadata.
- Services offered by an SDI.
- Software:

The importance of using free software



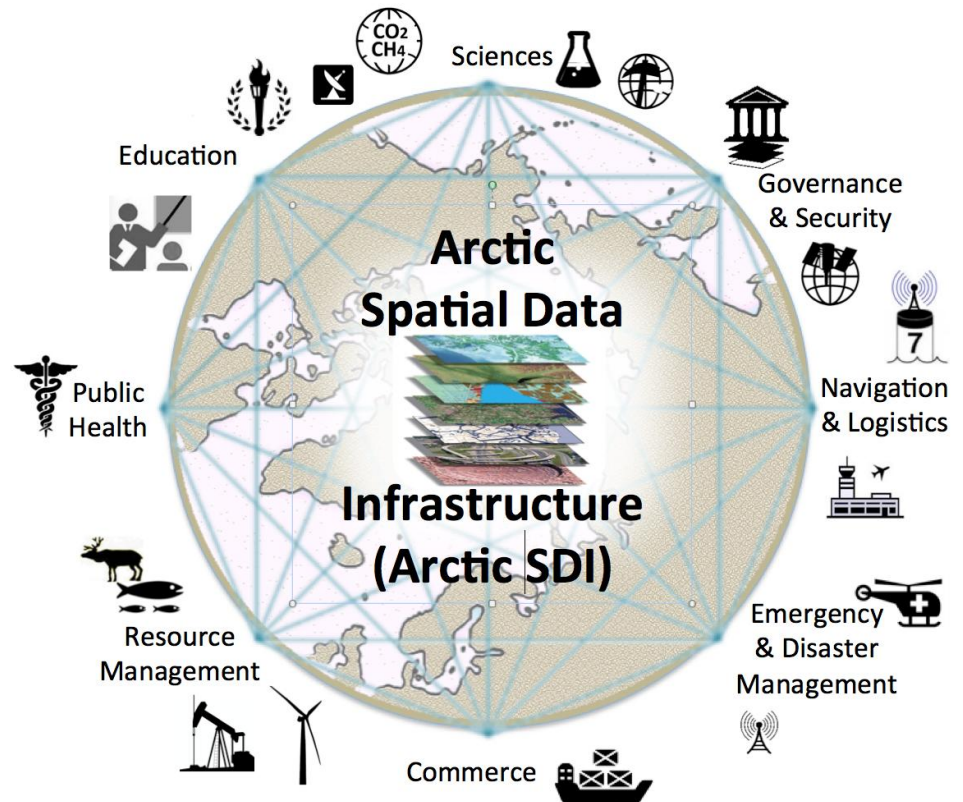
CONTENTS

Design of an SDI (team work)

Project statement

Objectives

Information layers
and data bases that
will be included



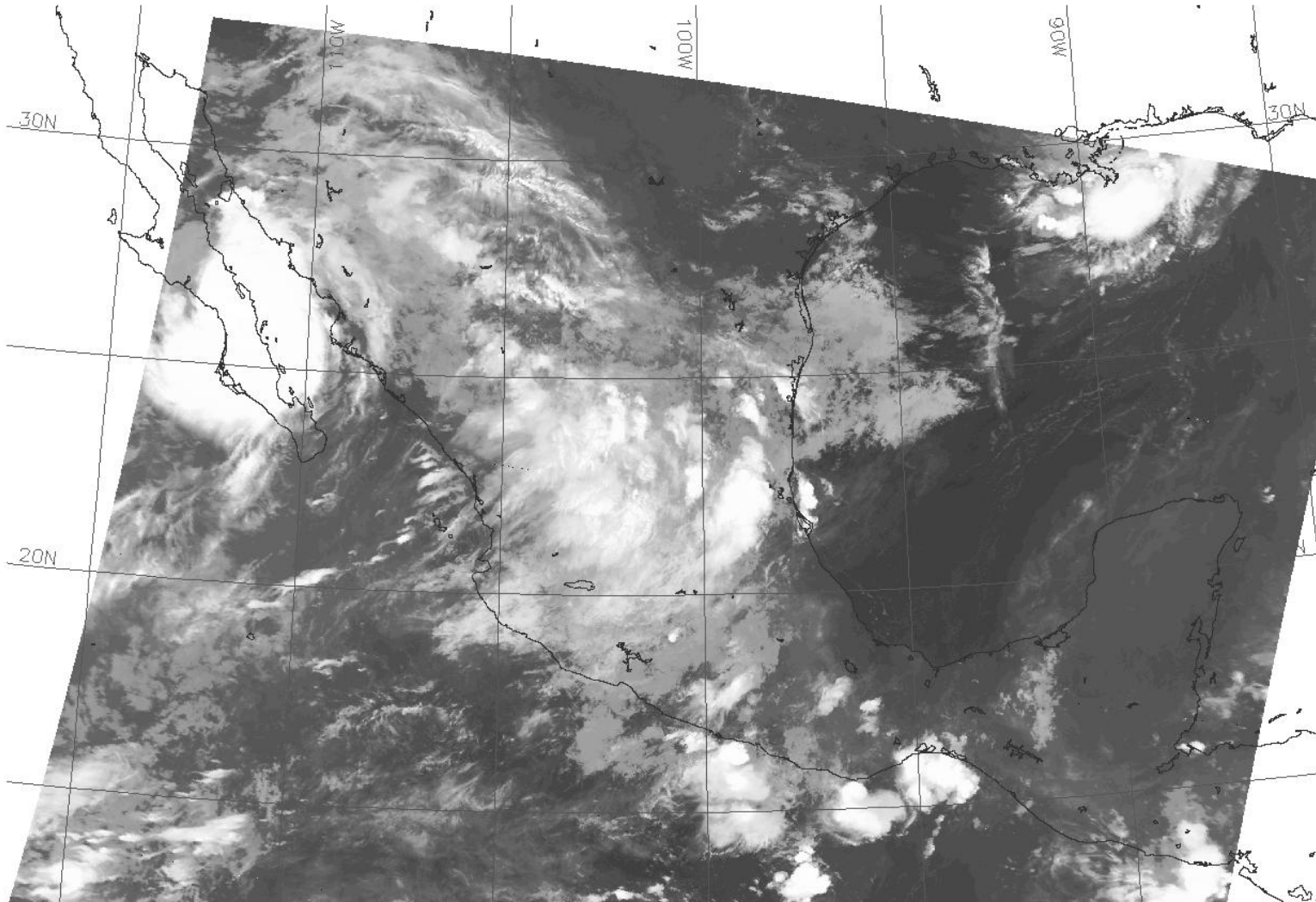
•GEOGRAPHIC INFORMATION (GI)

What is Geographic information?

The data about the entities or features that can be referenced to specific places relating to below, on or above the Earth's surface.



Geographic information



What is Geographic information?

All data linked to a Terrestrial position

It could be : Maps, images, archives, descriptions . . . Anything georeferenced, i.e. linked to a geographical position, by means of geographic coordinates, place names, a postal address, etc.



What is Geographic information?

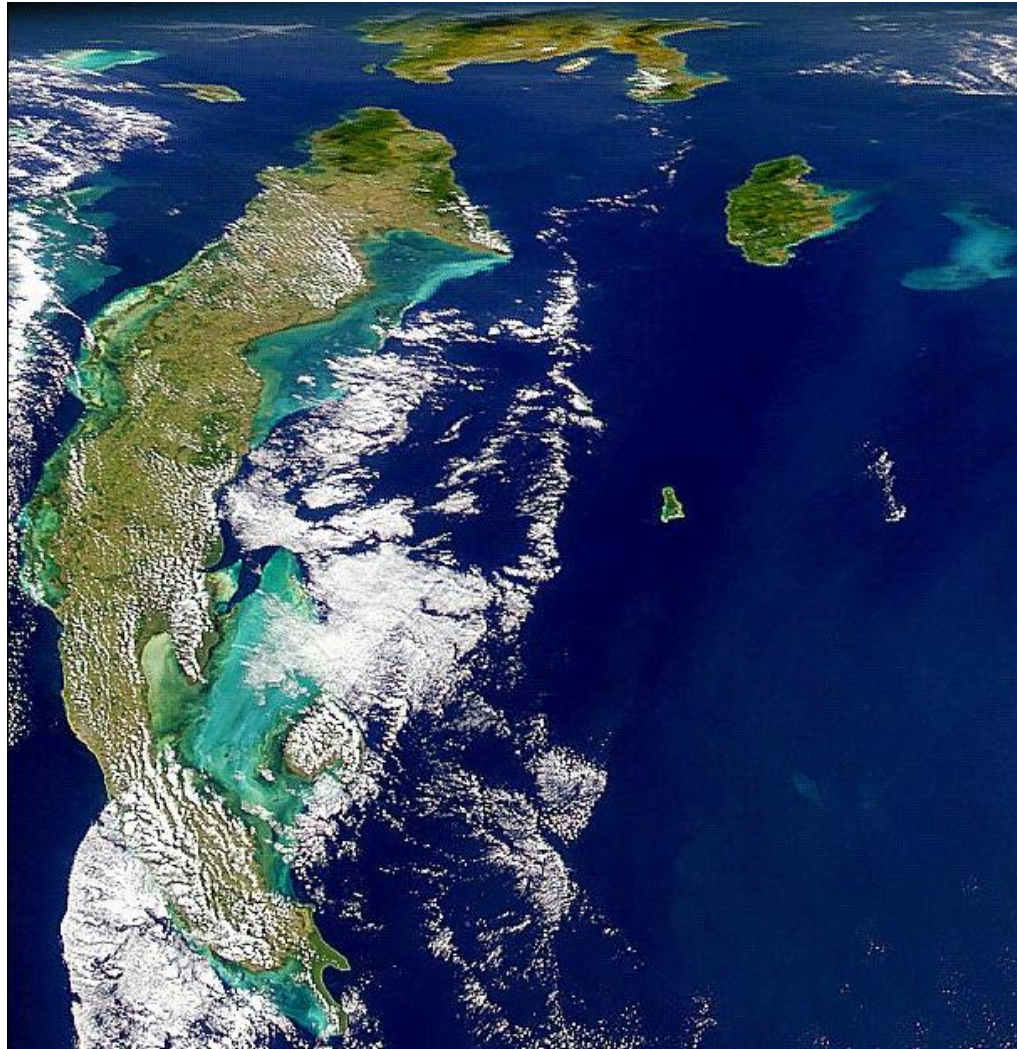
- GI represents certain complexity.

It is complex due to the big amount of elements that composes it:

Population, buildings, relief, land uses . . .



Geographic information



Geographic information

Project name: CEN_MAYO14_2008_BUENO_ITRF92.ttp

Surveyor:

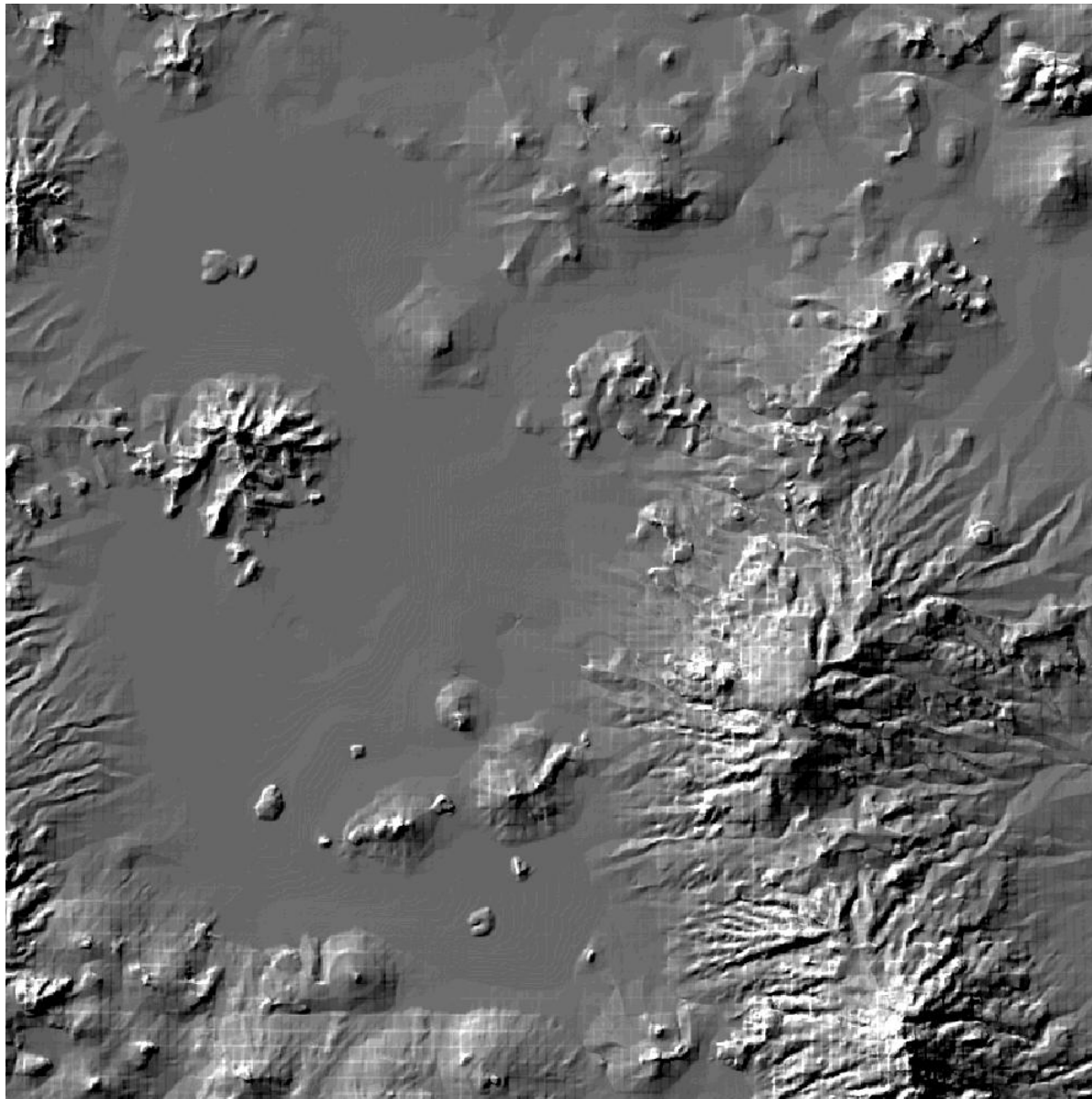
Comment:

Linear unit: Meters

Projection: UTMNorth-Zone 12 : 114W to 108W

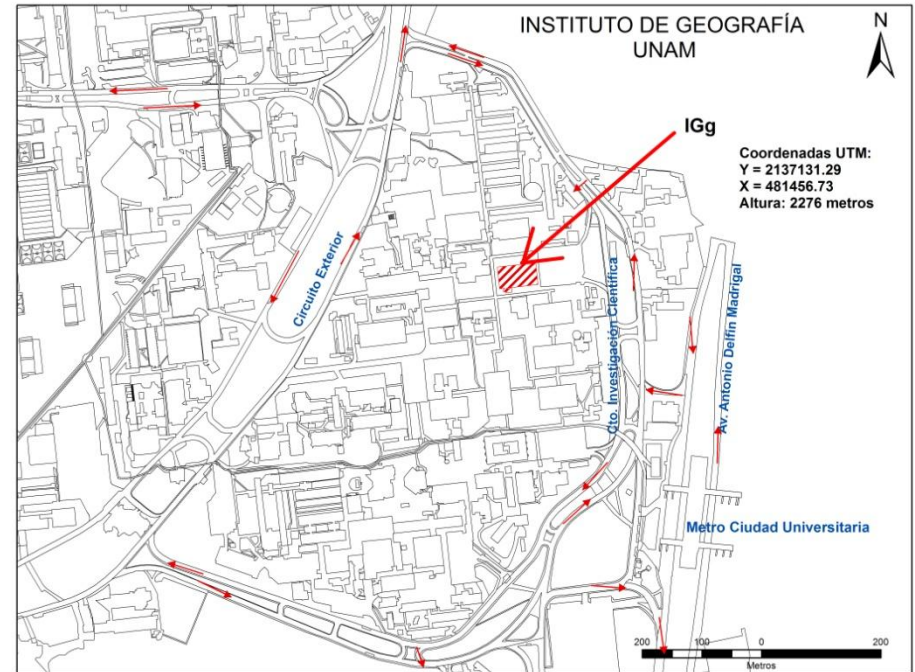
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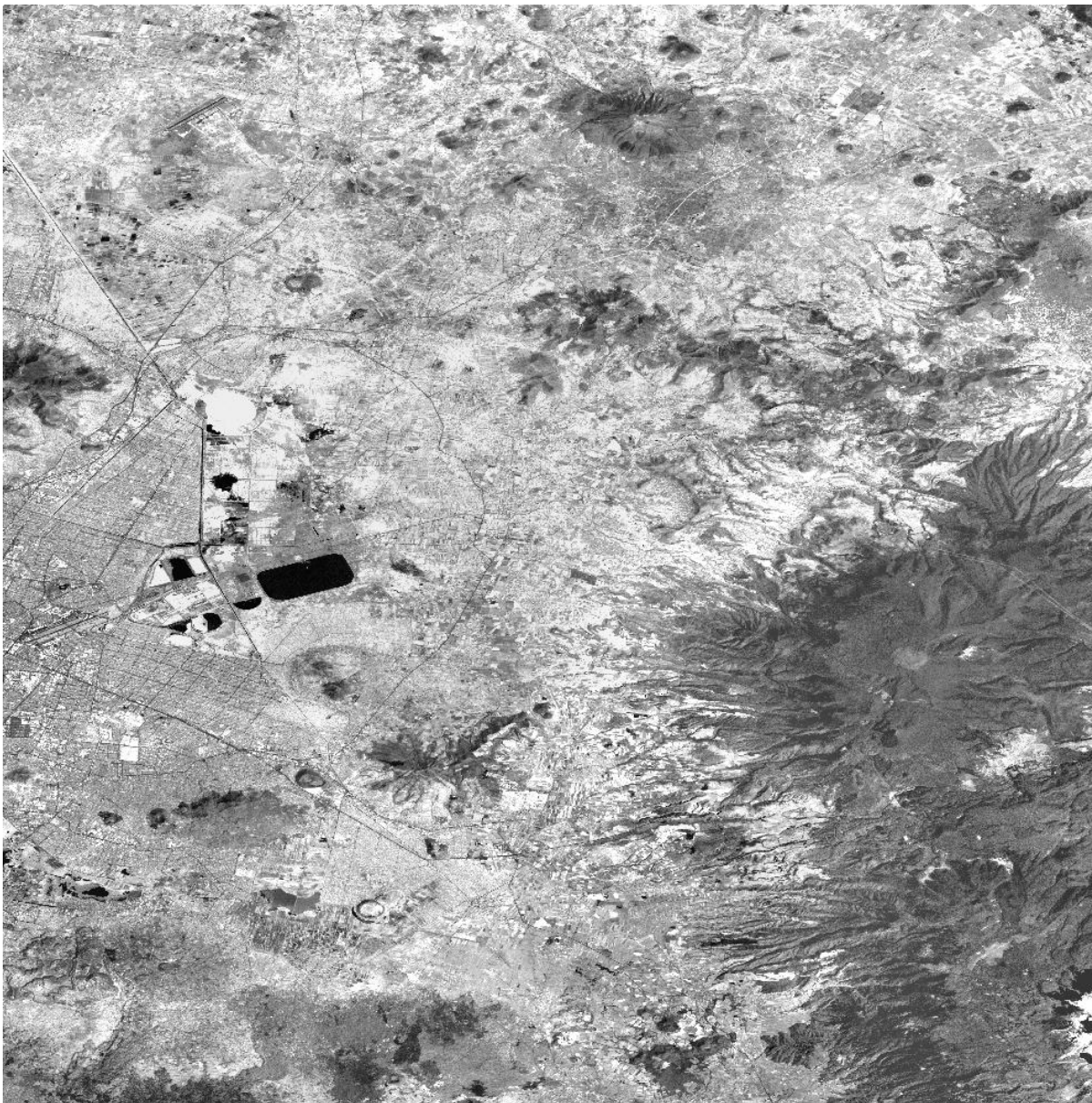
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	Grid Northing (m)	Grid Easting (m)	Elevation (m)	
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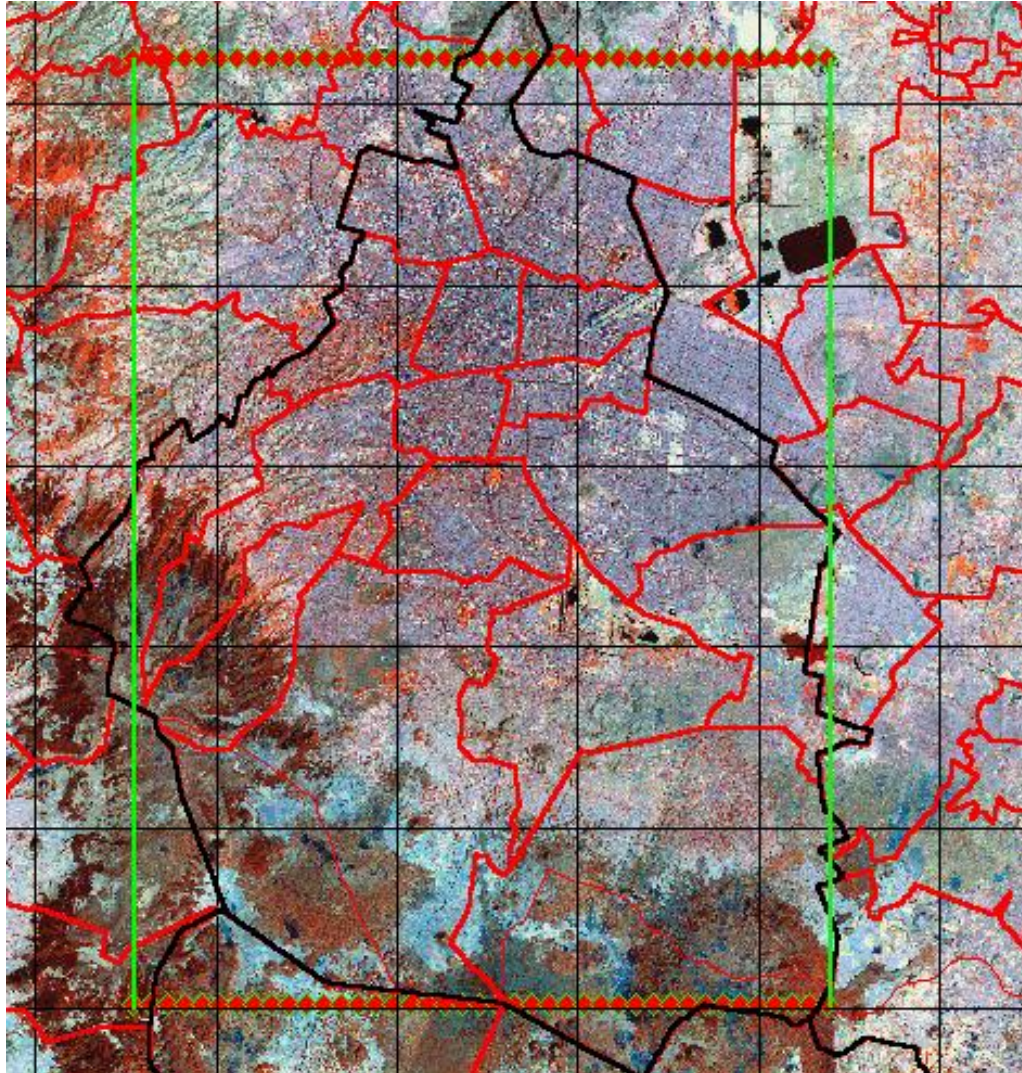


Geographic information

It is complex by its dimensional properties: It could be a point, a line, a surface, a volume or even an space-temporal phenomena.







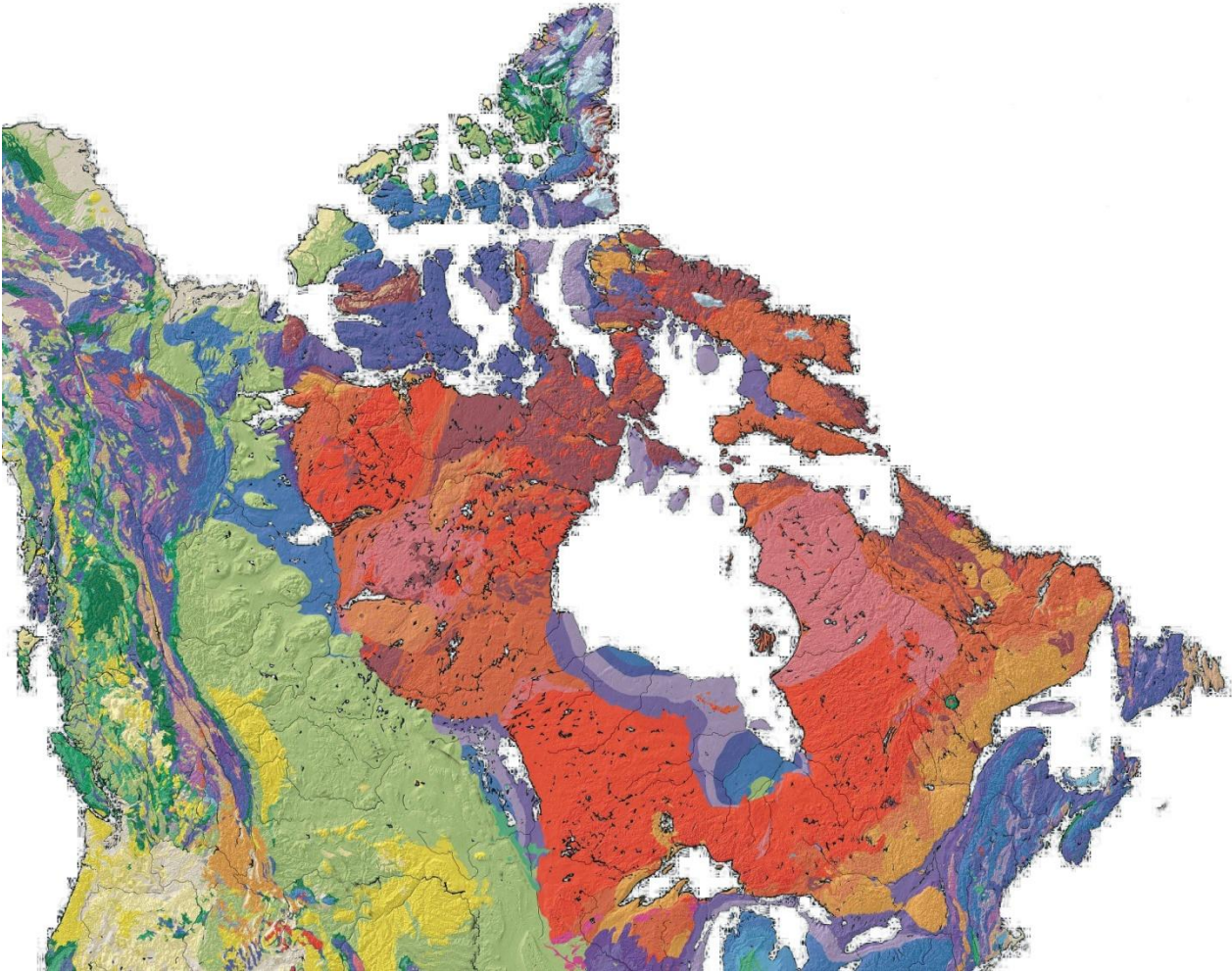
Geographic information

It is complex due to the different levels of measurements with which it is collected.

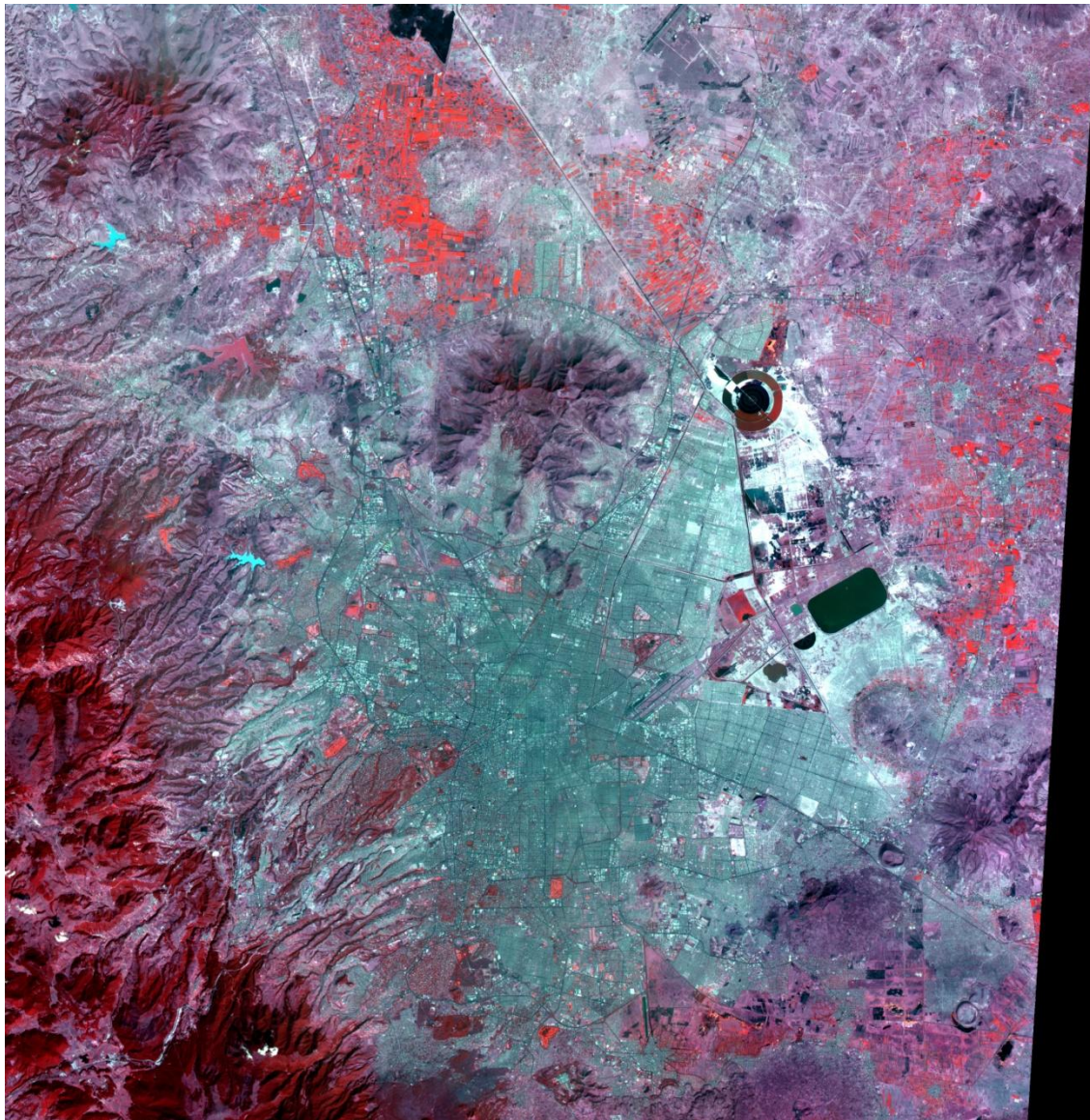
From a qualitative point of view: soil types (clay, sand, igneous rocks, metamorphic rocks, etc.)



Geological map of Canada







Geographic information

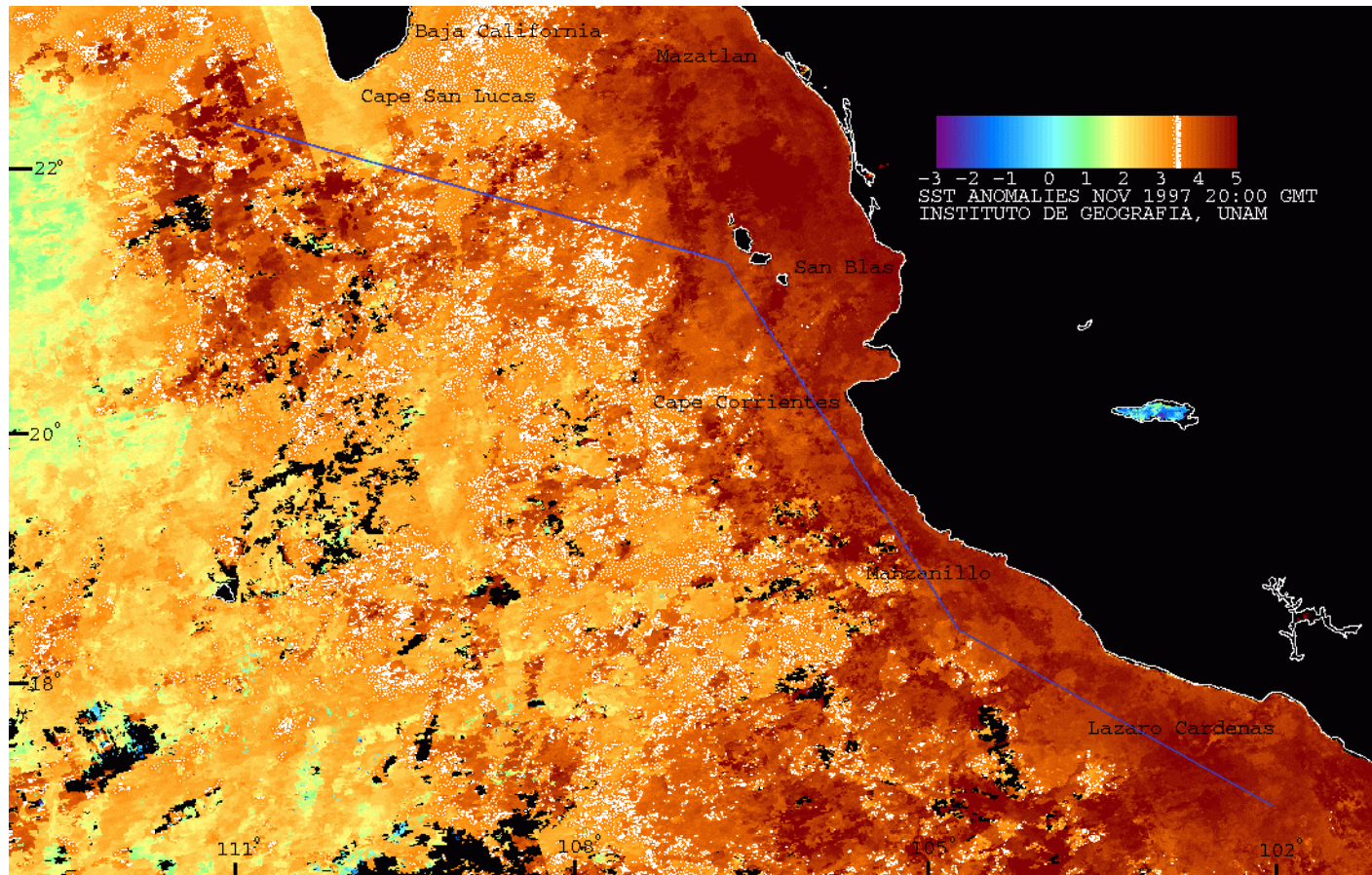
It is complex due to its distribution over the Earth's surface:

Continuous (appears in all of the points of the planet, like the atmospheric pressure or temperature).

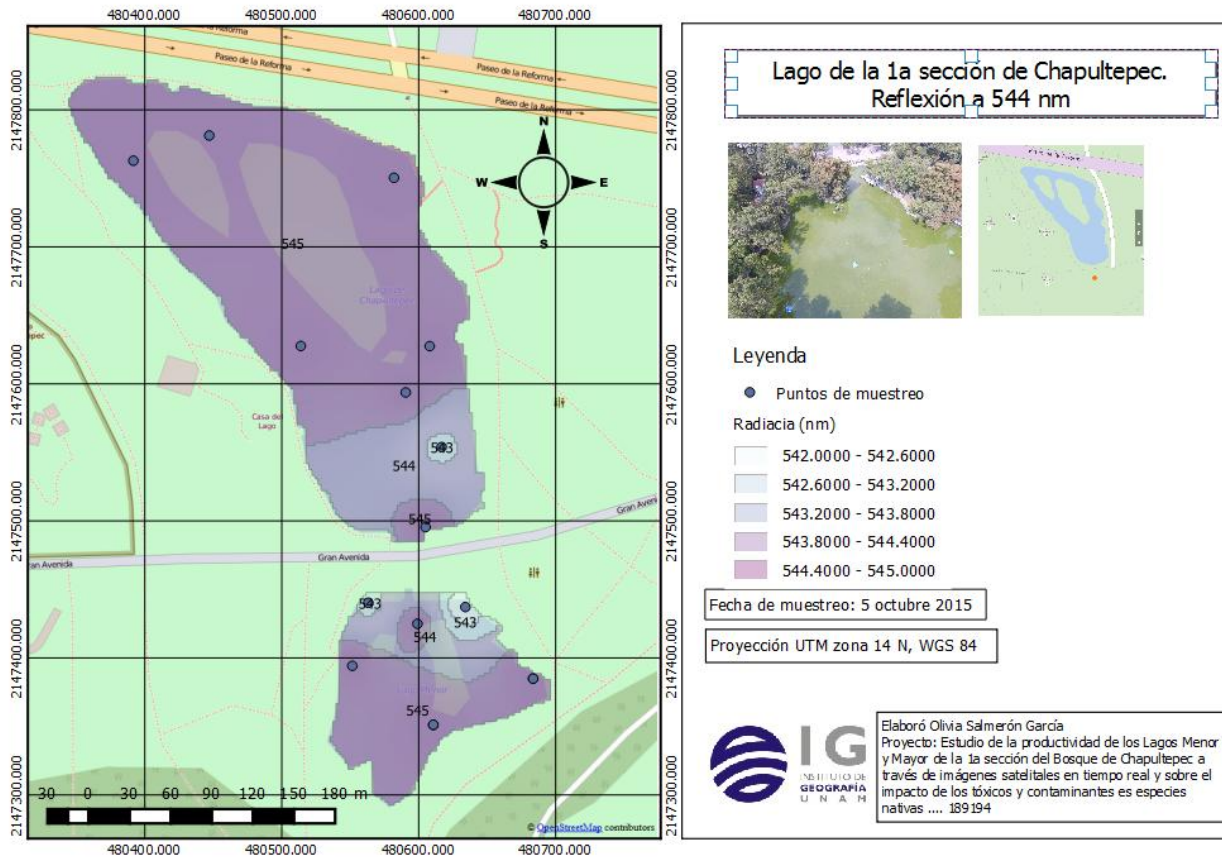


Geographic information

Ocean temperatures



Radiances measured in-situ Chapultepec lake, Mexico City.



GEOGRAPHIC INFORMATION SYSTEMS

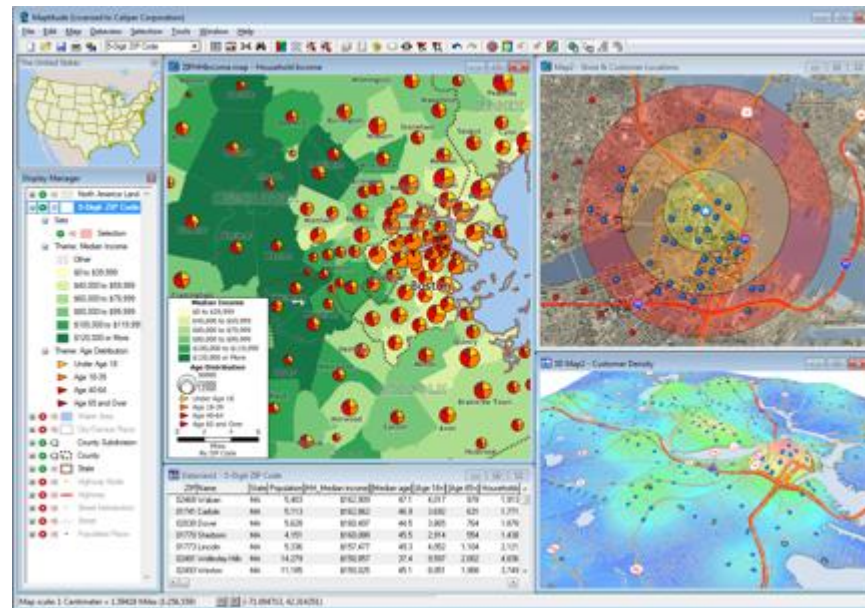
Management of GI represents certain complexity when all its potential is supposed to be exploited.

The hard work of the past of comparing one map with another (at different scales and different projections) actually is performed by a software called Geographic Information System.



GEOGRAPHIC INFORMATION SYSTEMS

This software stores GI in data bases and are equipped with an output graphic system to display information.

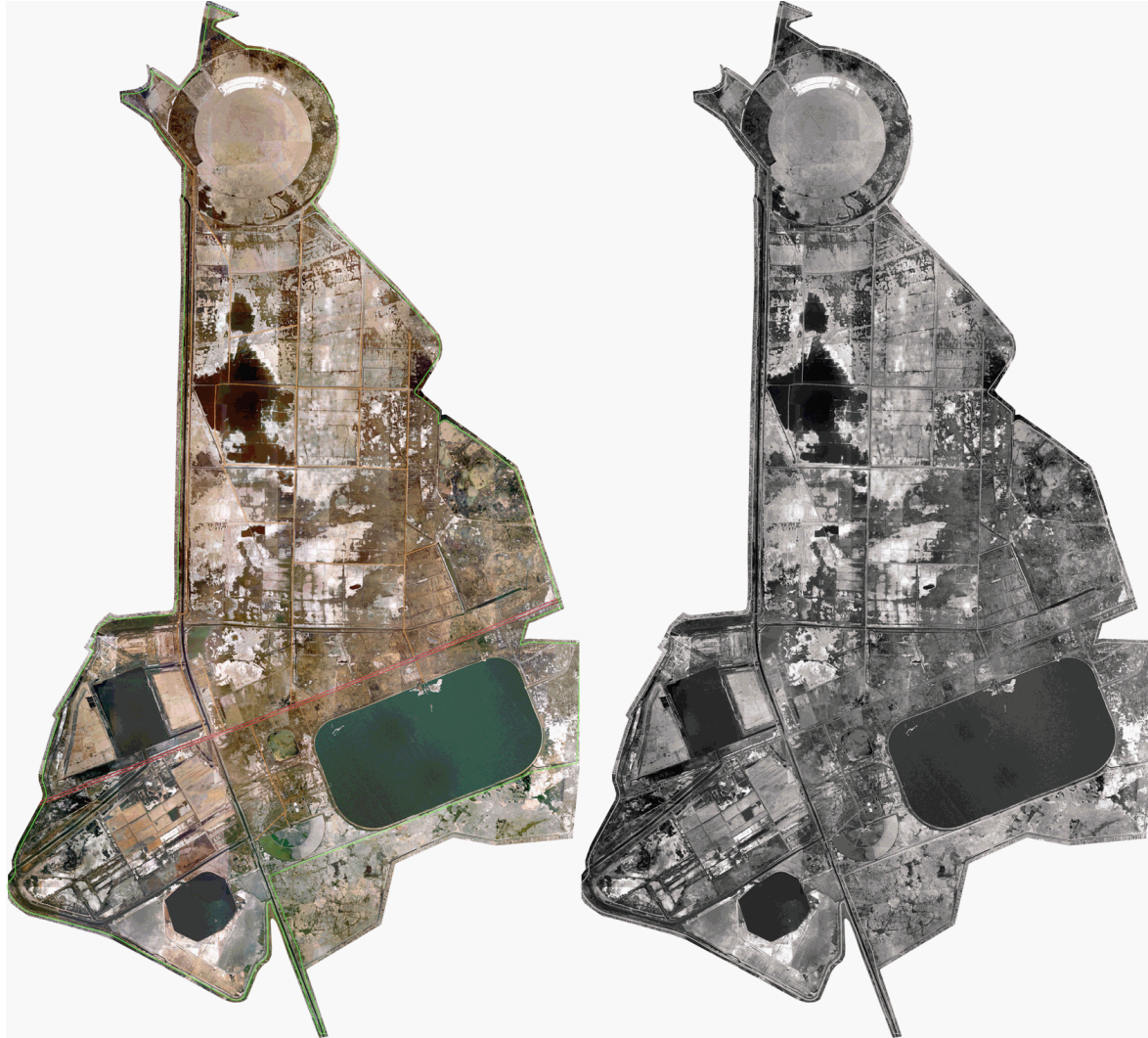


GEOGRAPHIC INFORMATION SYSTEMS

In this way, users can query to data bases and obtain a graphic response, generally in the form of a map.

This map usually corresponds to the interception of different layers of information, is a new information of the territory, ready to be visualized, analyzed, and published.

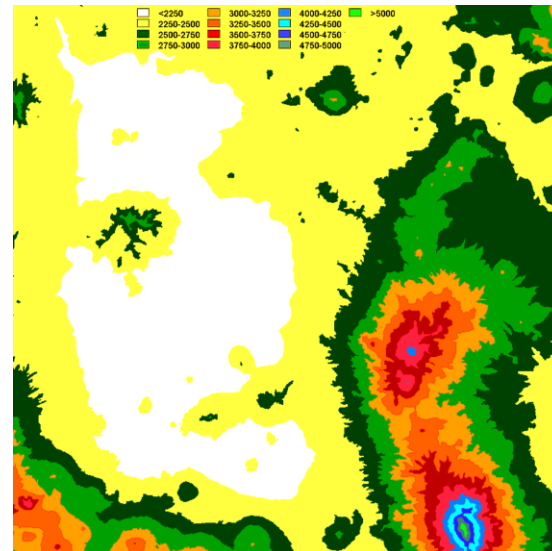
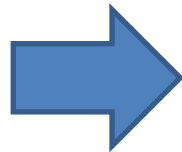




Geographic Information Systems

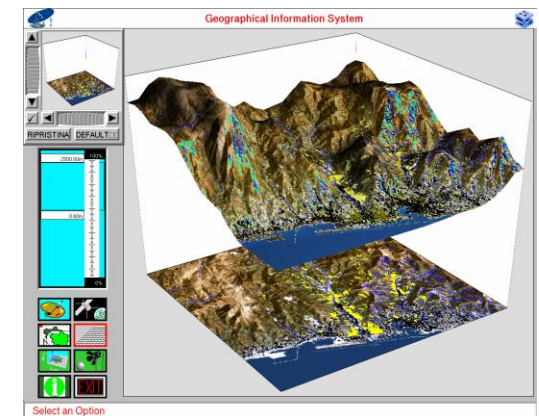
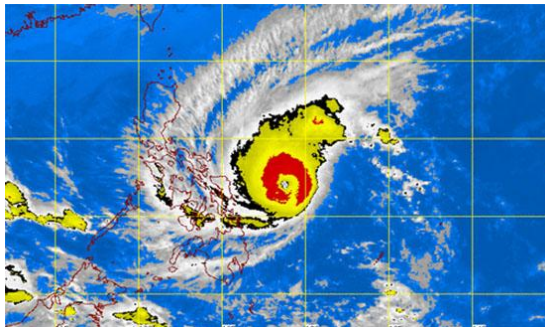
- Geographic information systems are used to predict, manage and learn about all kinds of phenomena affecting the Earth, its systems and inhabitants.

DEM used to
determine
flooding



Geographic Information Systems

- The many applications of geospatial analysis include crisis management, climate change modeling, weather monitoring, sales analysis, human population forecasting and natural resources management.



Geographic Information Systems.

Geospatial analysis

- Geospatial analysis is the gathering, display, and manipulation of imagery, GPS, satellite photography and historical data, described explicitly in terms of geographic coordinates or implicitly, in terms of a street address, postal code, or forest stand identifier as they are applied to geographic models.



Data gathering: GPS

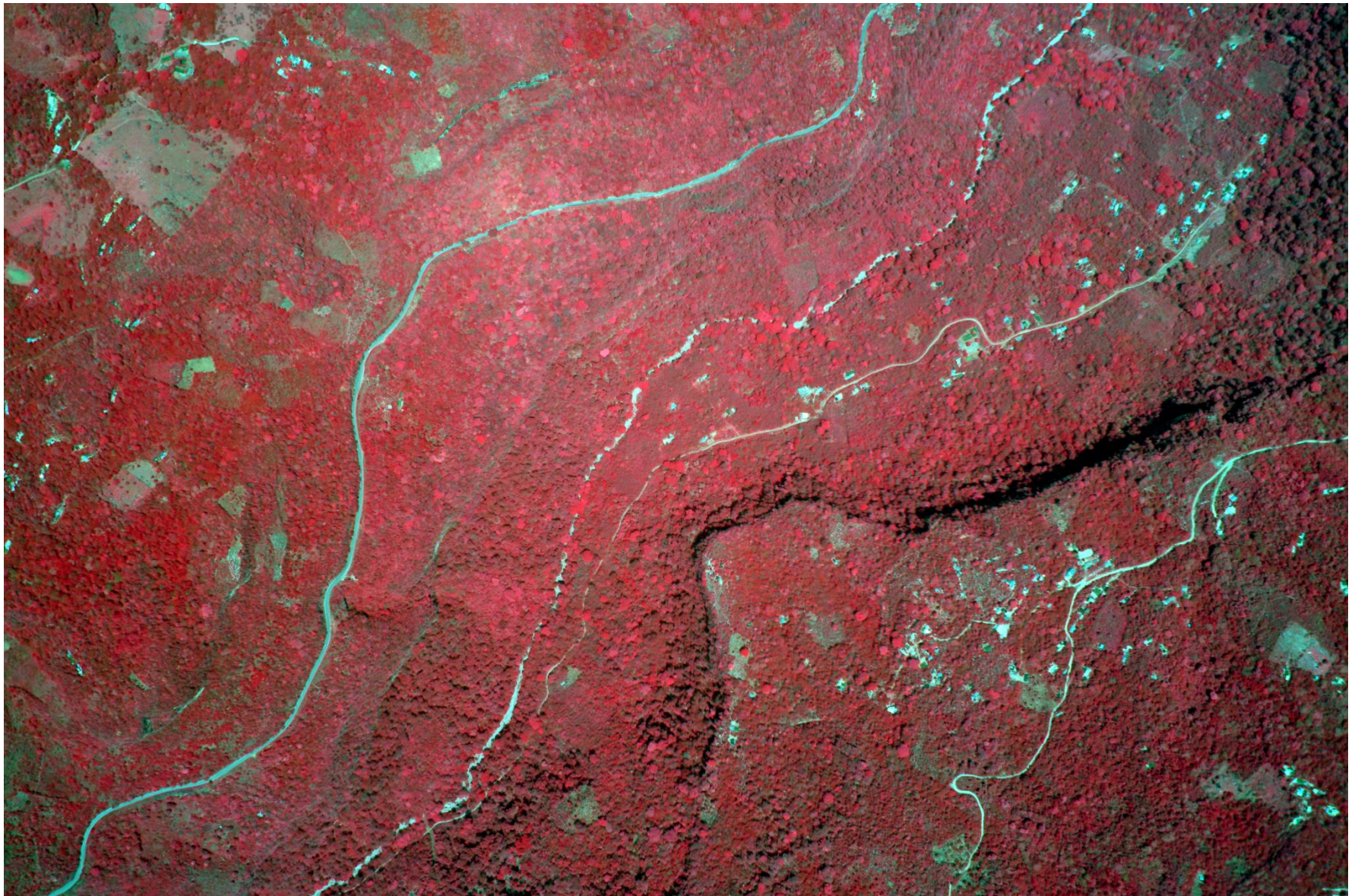






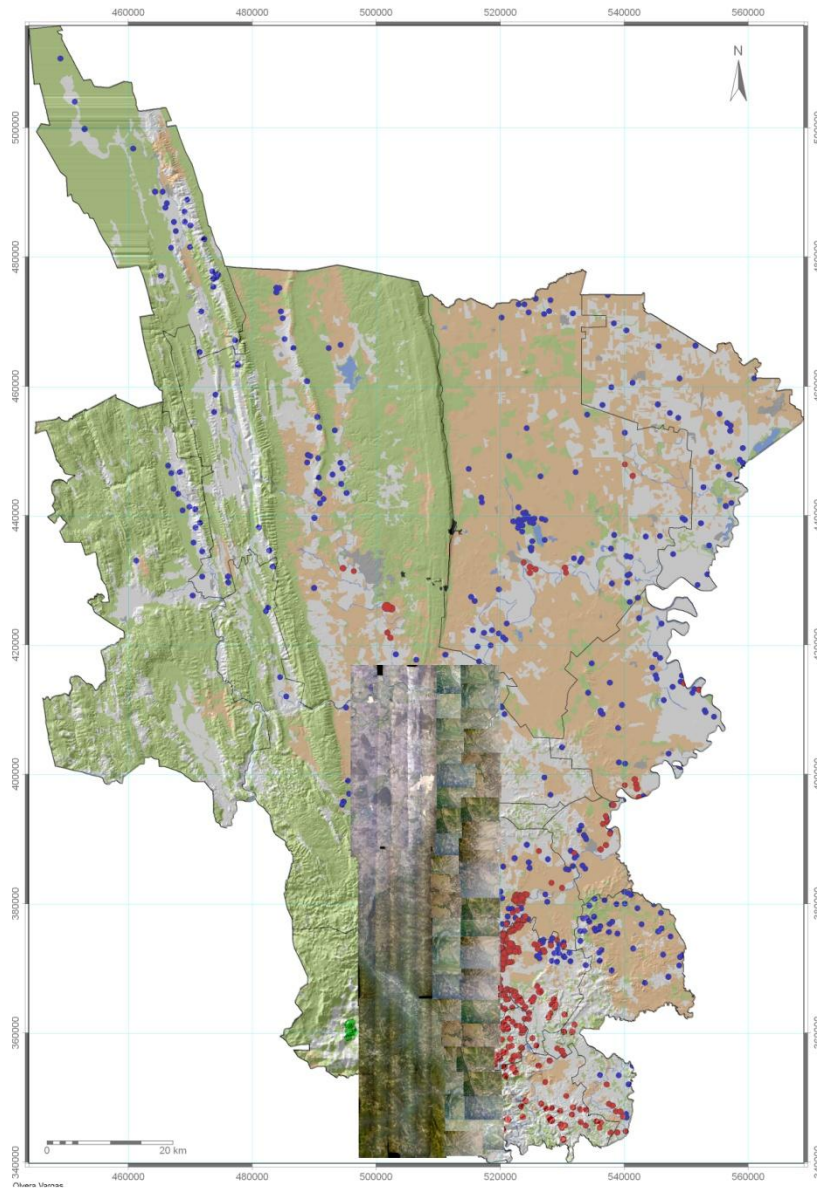
Data gathering: Small-Format Digital Imagery

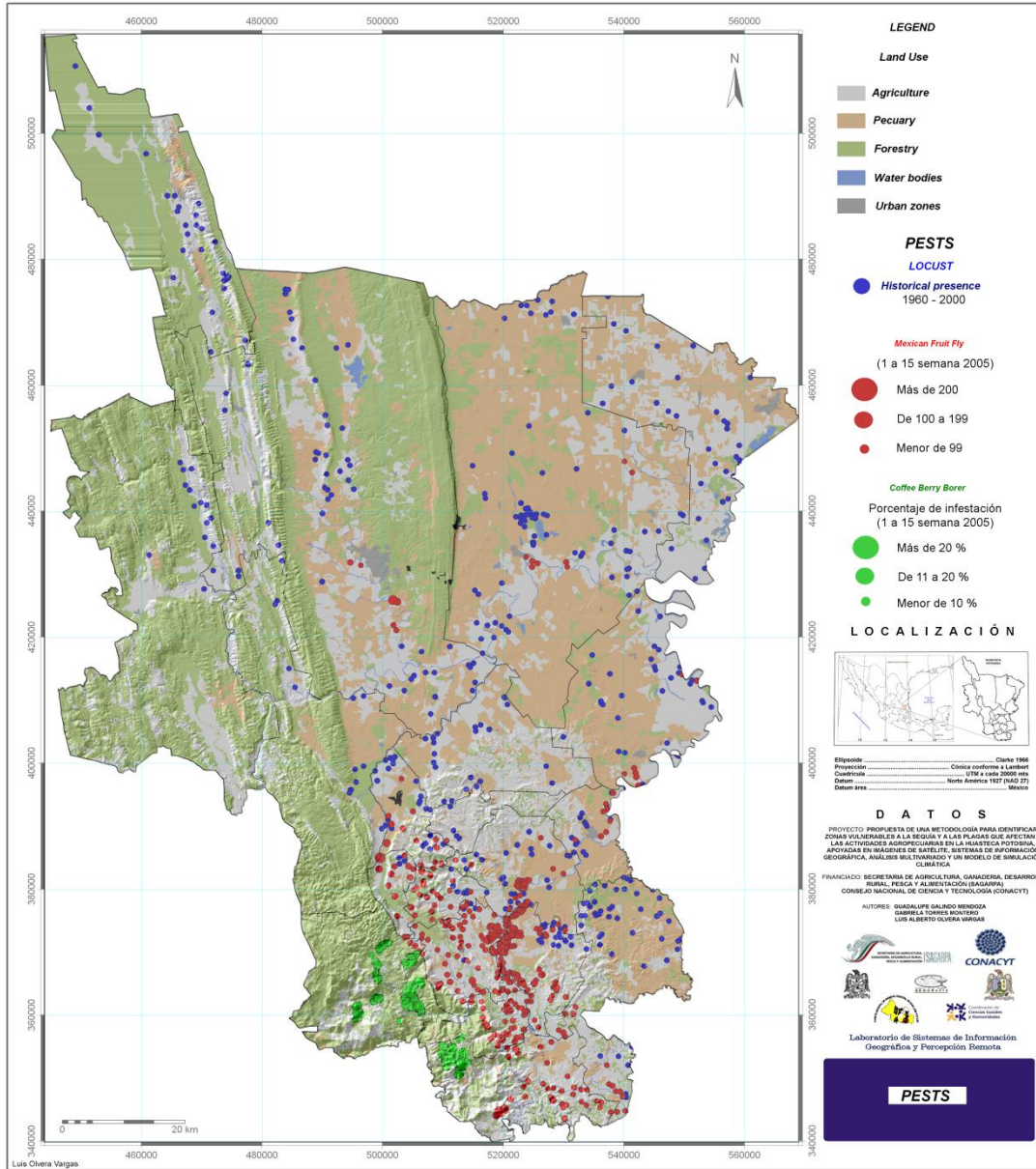








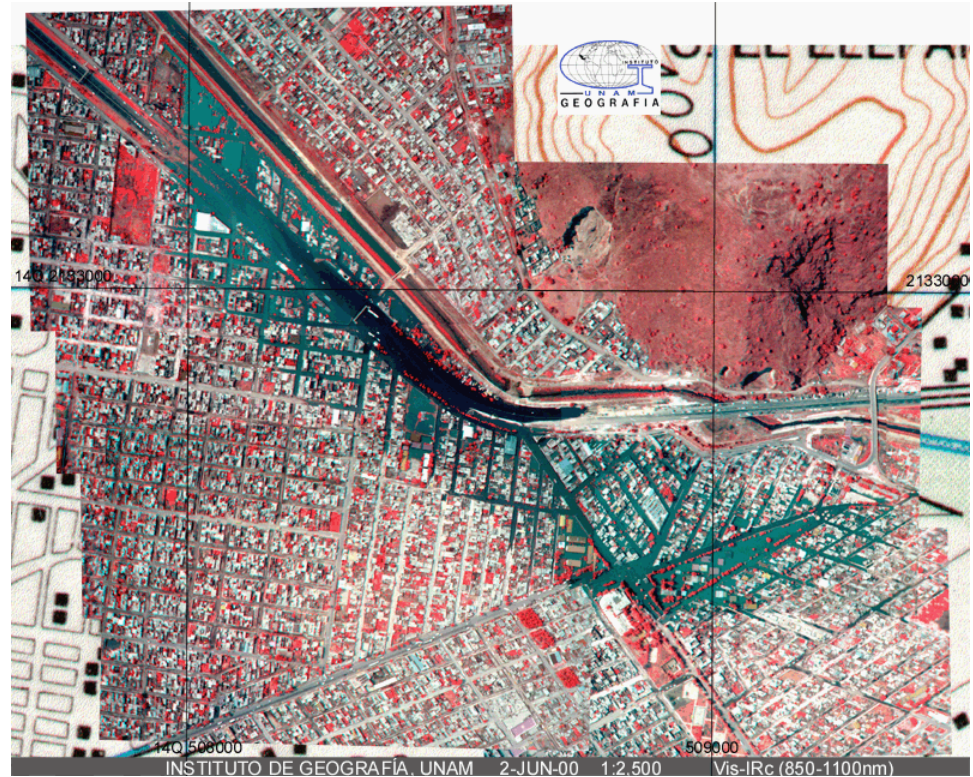




Geospatial Information Management

- It is defined as:

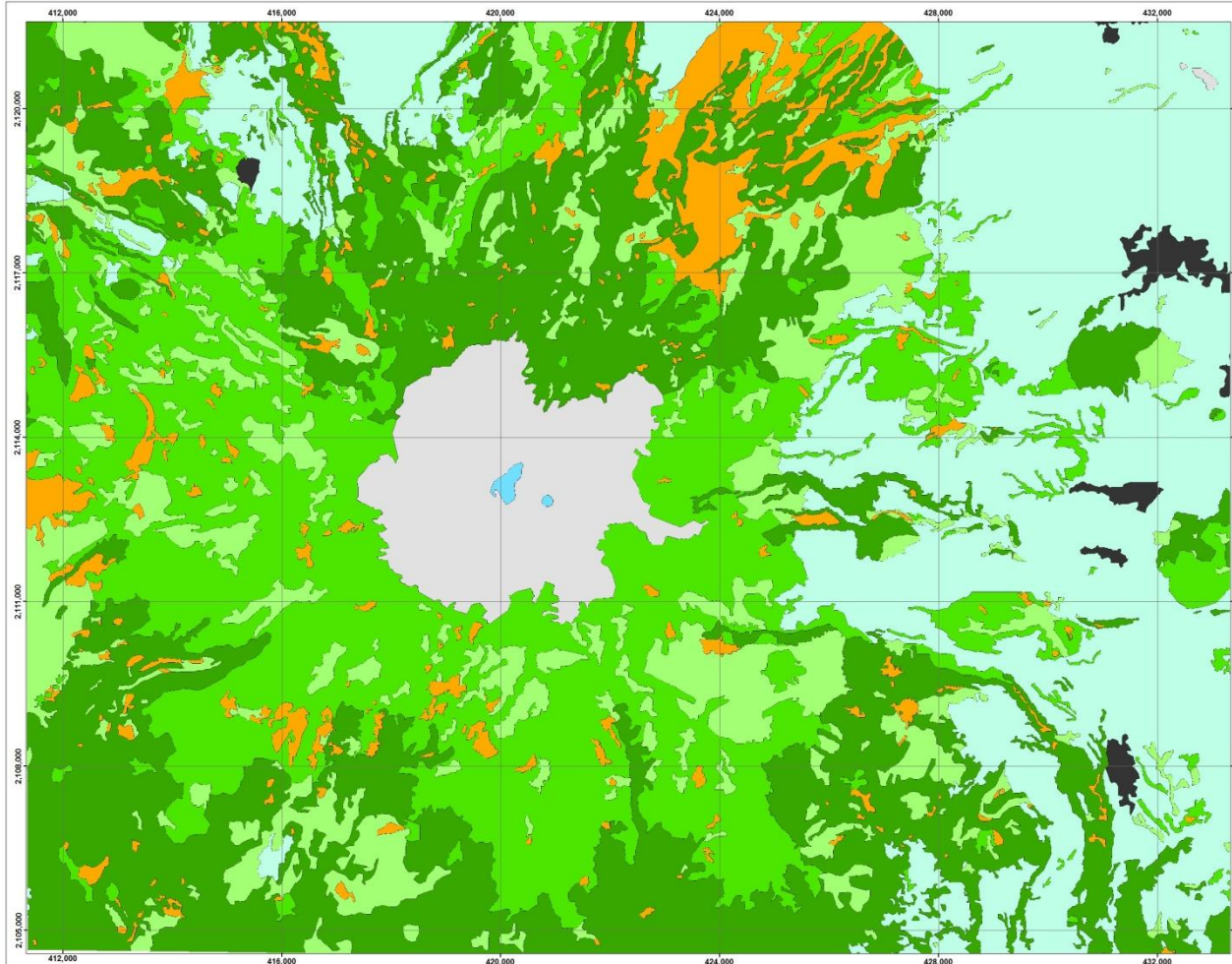
Management of all types of geospatial information for better decision-making and policy formulation to meet humanitarian needs, peace and security, environmental and development challenges through the maximized use of geospatial information.



Long-term vegetation changes

1993

NEVADO DE TOLUCA

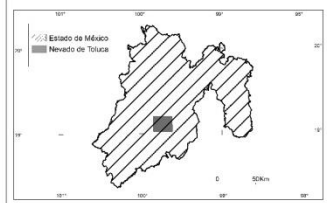


SECRETARÍA DEL MEDIO AMBIENTE
 PROTECTORA DE BOSQUES DEL ESTADO DE MÉXICO
 Dirección de Restauración y Fomento Forestal
 Proyecto "IDENTIFICACIÓN DE ÁREAS PERTURBADAS MEDIANTE LA IMPLEMENTACIÓN DE UN SIG PARA RESTAURACIÓN Y REFORESTACIÓN"
 Convenio entre el Instituto de Geografía UNAM y PROBOSQUE Imagen SPOT del 9 de febrero del 2015.

LEYENDA

COBERTURA 1993

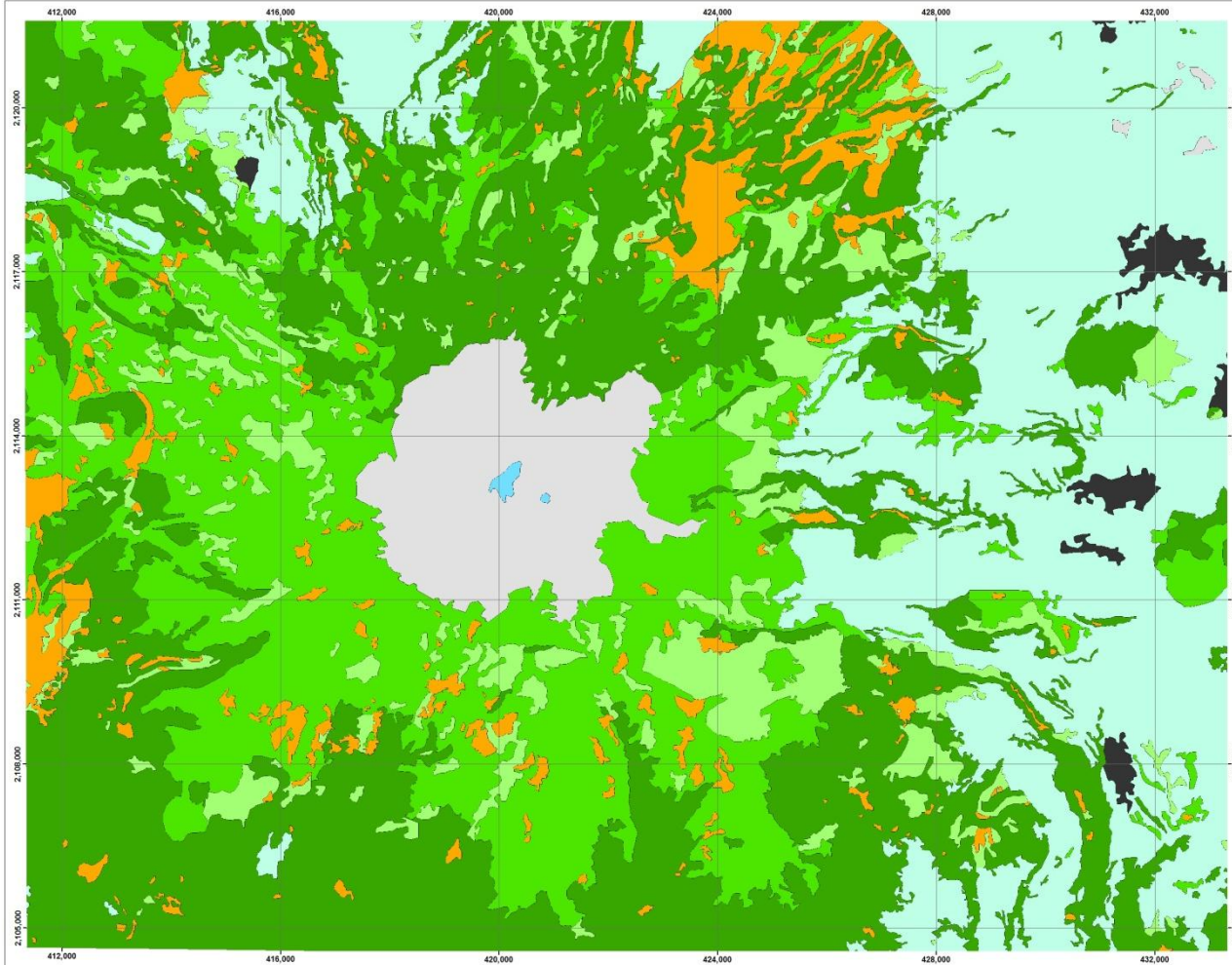
1. CUERPO DE AGUA
2. ASENTAMIENTOS URBANOS
3. AGRICULTURA
4. PASTIZAL
6. BOSQUE CON MENOS DE 30% DE COBERTURA
7. BOSQUE CON ENTRE 30 Y 60% DE COBERTURA
8. BOSQUE CON MAS DEL 60% DE COBERTURA
12. SIN VEGETACIÓN APARENTE



Proyección UTM
 Estereode WGS 84
Mapa de cobertura vegetal 1993
 Producto de interpretación de ortofotos de INEGI a escala 1:75,000



NEVADO DE TOLUCA

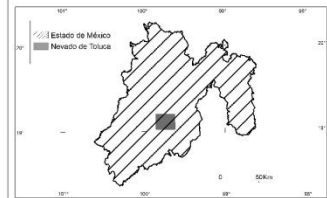


SECRETARÍA DEL MEDIO AMBIENTE
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 Convenio entre el Instituto de Geografía UNAM y PROBOSQUE Imagen SPOT del 9 de febrero del 2015.

LEYENDA

COBERTURA 2016

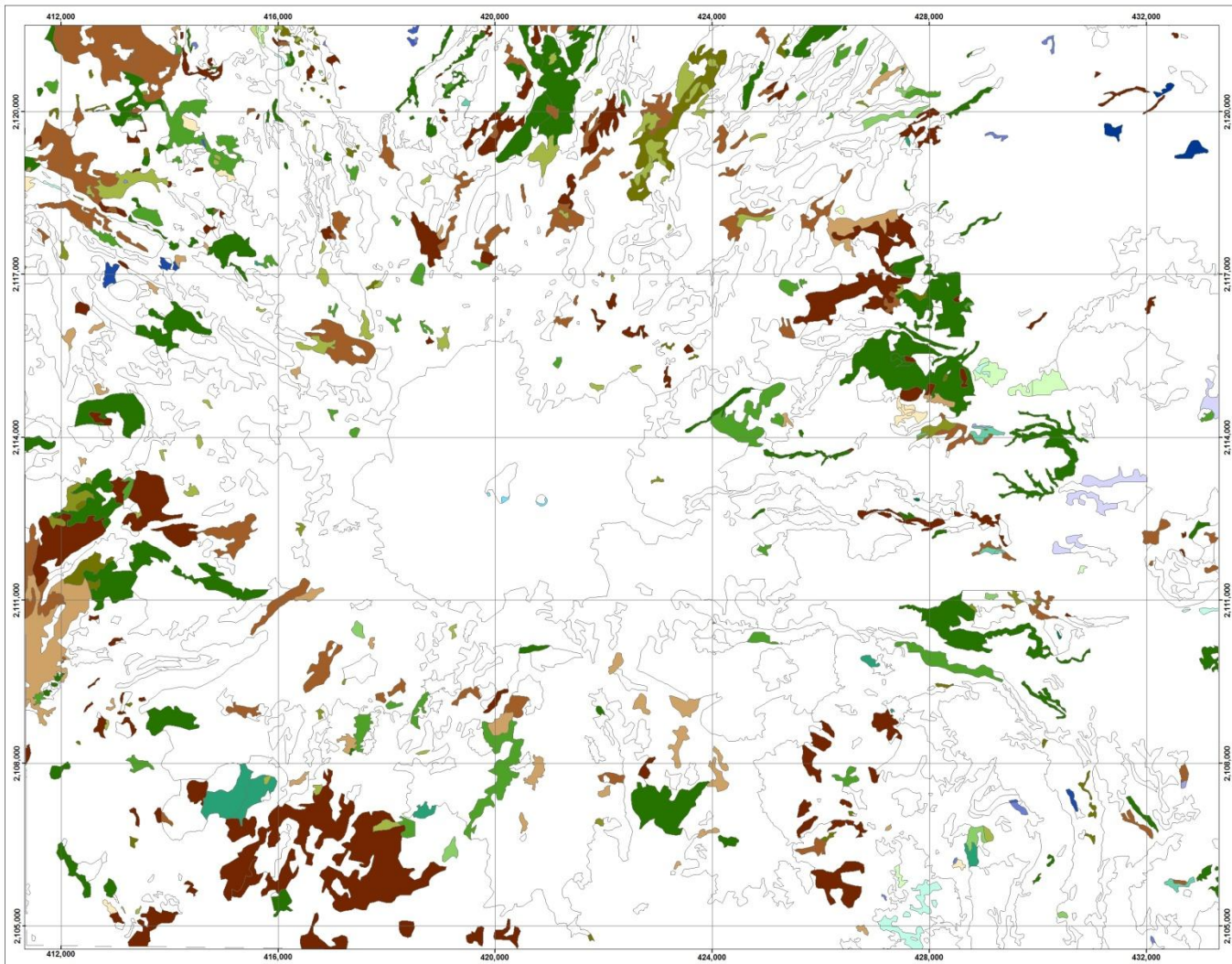
1. CUERPO DE AGUA
2. ASENTAMIENTOS URBANOS
3. AGRICULTURA
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5. BOSQUE CON MENOS DE 30% DE COBERTURA
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8. BOSQUE CON MAS DEL 60% DE COBERTURA
9. SIN VEGETACIÓN APARENTE



Proyección UTM
 Esferoide WGS 84

Mapa de cobertura vegetal 2015.
 Producto de interpretación visual de imágenes SPOT de 2015

NEVADO DE TOLUCA



GOBIERNO DEL ESTADO DE MÉXICO **EN GRANDE** LOGO PROYECTO

SECRETARÍA DEL MEDIO AMBIENTE
PROTECTORA DE BOSQUES DEL ESTADO DE MÉXICO
Dirección de Restauración y Fomento Forestal

Proyecto "IDENTIFICACIÓN DE ÁREAS PERTURBADAS MEDIANTE LA IMPLEMENTACIÓN DE UN SIG PARA RESTAURACIÓN Y REFORESTACIÓN"

Convenio entre el Instituto de Geografía UNAM y PROBOSQUE Imagen SPOT del 9 de febrero del 2015.

LEYENDA

DE DESCRIPCIÓN DEL CAMBIO

- SIN CAMBIO
- DE AGRICULTURA A PASTIZALES URBANOS
- DE AGRICULTURA A BOSQUE CON MÁS DEL 50% DE COBERTURA
- DE AGRICULTURA A BOSQUE CON MENOS DEL 50% DE COBERTURA
- DE AGRICULTURA A PASTIZAL
- DE AGRICULTURA SIN VEGETACIÓN APARENTE
- DE BOSQUE CON MENOS DEL 30% DE COBERTURA AGRICULTURA
- DE BOSQUE CON MENOS DEL 30% DE COBERTURA A PASTIZAL
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- DE BOSQUE CON ENTRE 30 Y 50% DE COBERTURA A BOSQUE CON MÁS DEL 50% DE COBERTURA
- DE BOSQUE CON MÁS DEL 50% DE COBERTURA AGRICULTURA
- DE BOSQUE CON MÁS DEL 50% DE COBERTURA A BOSQUE CON ENTRE 30 Y 50% DE COBERTURA
- DE BOSQUE CON MÁS DEL 50% DE COBERTURA A BOSQUE CON MENOS DEL 30% DE COBERTURA
- DE BOSQUE CON MÁS DEL 50% DE COBERTURA A PASTIZAL
- DE PASTIZAL CUERPO DE AGUA
- DE PASTIZAL SIN VEGETACIÓN APARENTE
- DE PASTIZAL A AGRICULTURA
- DE PASTIZAL A BOSQUE CON MENOS DEL 30% DE COBERTURA
- DE PASTIZAL A BOSQUE CON ENTRE 30 Y 50% DE COBERTURA
- DE PASTIZAL A BOSQUE CON MÁS DEL 50% DE COBERTURA
- DE CUERPO DE AGUA SIN VEGETACIÓN APARENTE
- DE SIN VEGETACIÓN APARENTE A AGRICULTURA

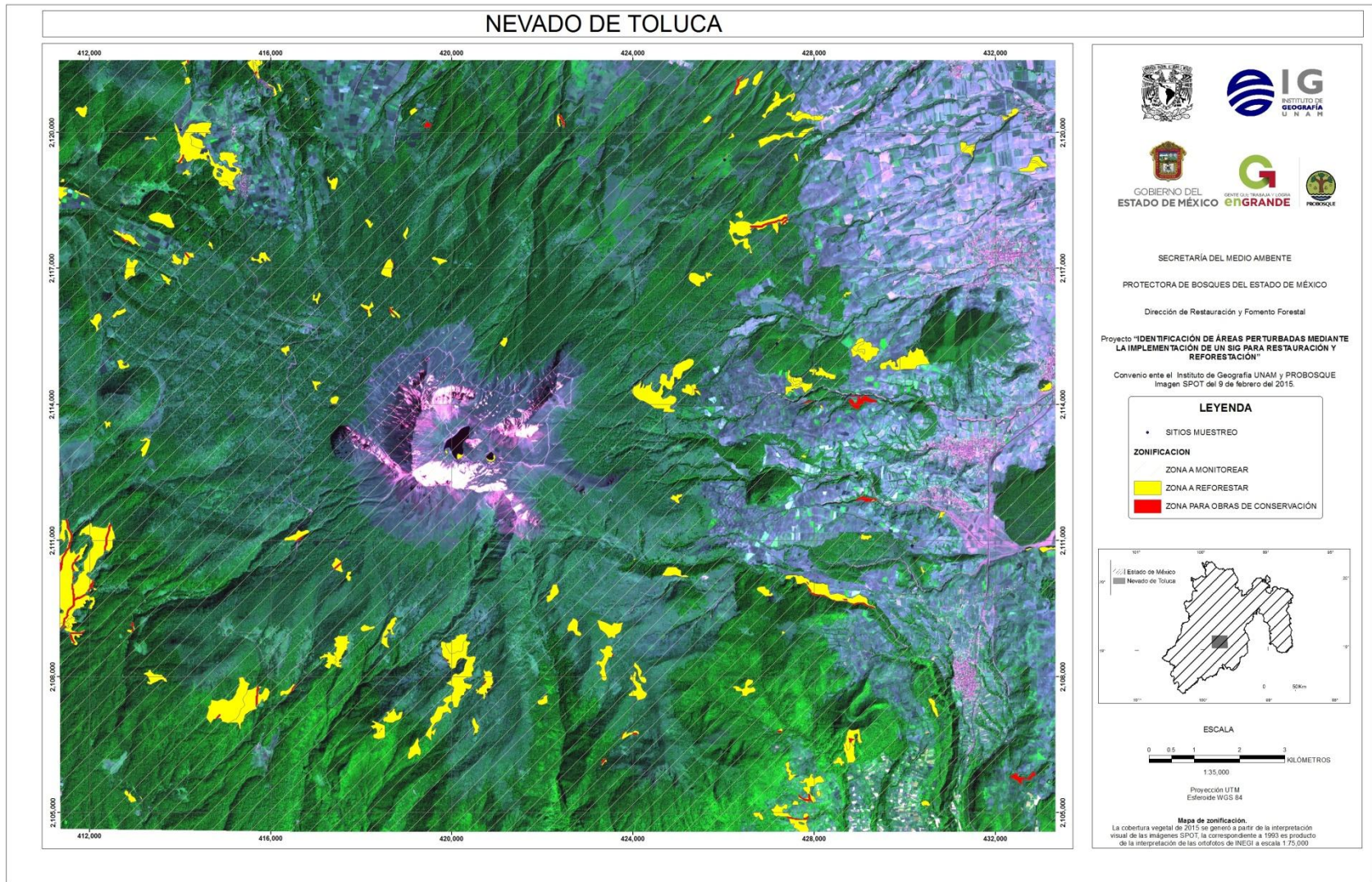
ESTADO DE MÉXICO
NEVADO DE TOLUCA

ESCALA 0 0.5 1 1.35 2 3 KILOMETROS

Proyección UTM
Eje horizontal WGS 84

Mapa de cambio de cobertura vegetal entre 1993 y 2015
La cobertura vegetal de 2015 se generó a partir de la interpretación visual de las imágenes SPOT la correspondiente a 1993 es producto de la interpretación de las ortofotos de INEGI a escala 1:75,000

Example of vegetation changes .



Difference between a map and a GIS

MAPS	SIG
Static contents	Contents are no longer static
Scale and symbology fixed	Scale and symbology adaptable
Difficult queries	Simple queries
Analysis and derived data difficult to obtain	Analysis and derived data simple to obtain

Connection between GIS's

What if we need to have access into a remote GIS?
In Brazil they have a GIS used to analyze forest fires.

How can we get connected?



We need an Spatial Data Infrastructure



What is an Spatial Data Infrastructure (SDI)?

SDI Definition and Key Capabilities

“The relevant base collection of technologies, policies and institutional arrangements that facilitate the availability of and access to spatial data”



HISTORY

SPATIAL DATA INFRASTRUCTURE

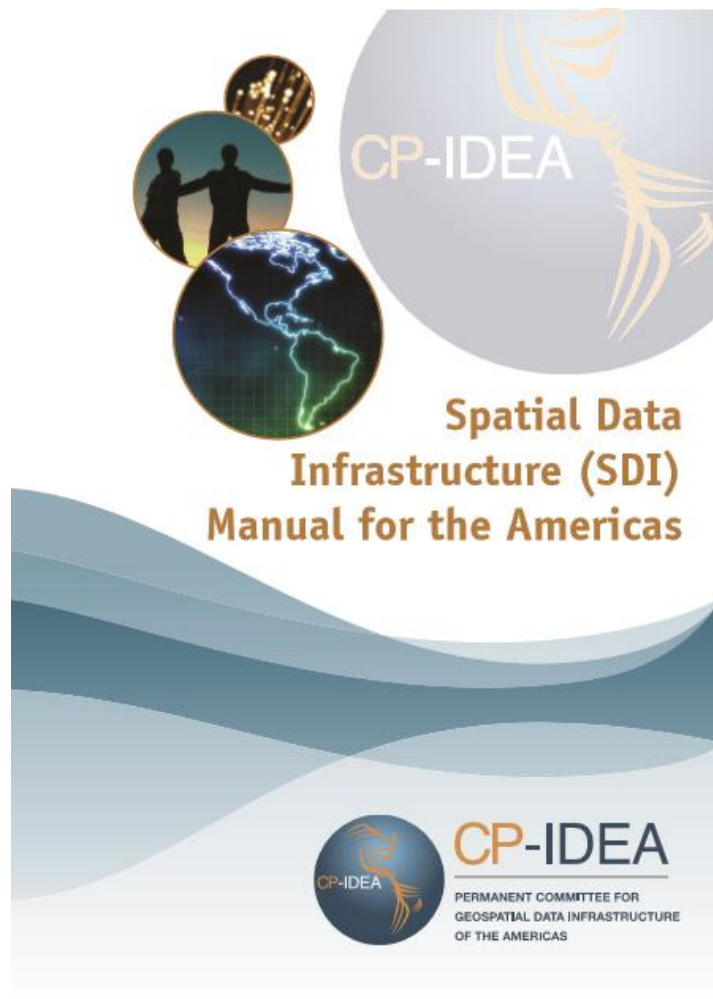
PERMANENT COMMITTEE FOR GEOSPATIAL DATA INFRASTRUCTURE OF THE AMERICAS (PC-IDEA)

PC-IDEA was established based on resolutions of the 6th United Nations Regional Cartographic Conference for the Americas (UNRCC-A) in 1997.



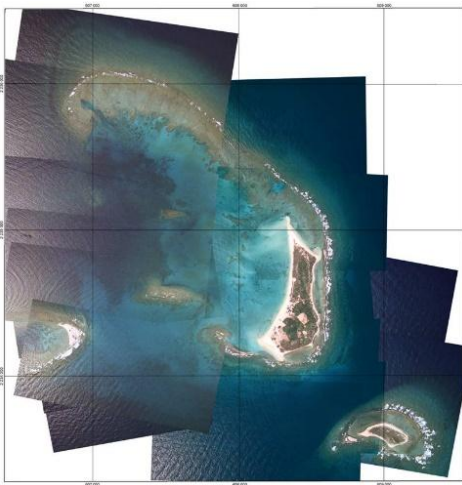
HISTORY

SPATIAL DATA INFRASTRUCTURE



HISTORY

The primary goal of PC-IDEA is to maximize the economic, social and environmental benefits of using spatial information, by exchanging knowledge, experiences and technologies of different countries, based on a common development model that allows for the establishment of an SDI in the Americas region.

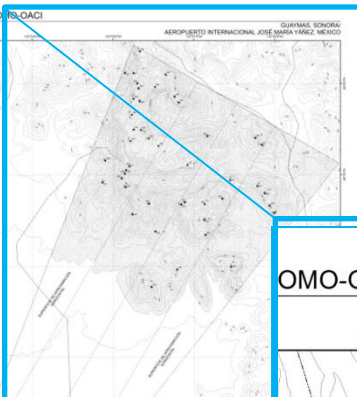


PLANO DE OBSTÁCULOS DE AERÓDROMOS-OACI
TIPO B

DECLINACIÓN MAGNÉTICA 10° E
VARIACIÓN ANUAL 0° 20' N
AÑO DE REFERENCIA 2005



GUAYMAS, SONORA
AEROPUERTO INTERNACIONAL JOSÉ MARÍA YÁNEZ, MÉXICO



OMO-OACI

GUAYMAS, SONORA/
AEROPUERTO INTERNACIONAL JOSÉ MARÍA YÁNEZ, MÉXICO

110°53'0"W 110°52'0"W 110°51'0"W 110°50'0"W



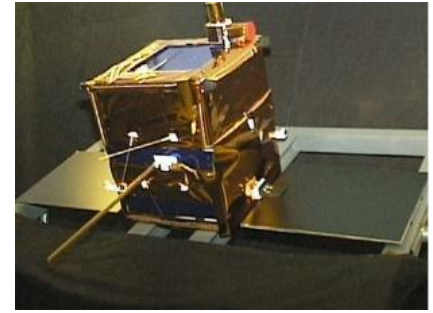
AGOSTO 2008



INSTITUTO DE
GEOGRAFÍA
UNAM

AGENCIA MEXICANA
DE COOPERACIÓN INTERNACIONAL
PARA EL DESARROLLO

HISTORY



Further goals of PC-IDEA include:

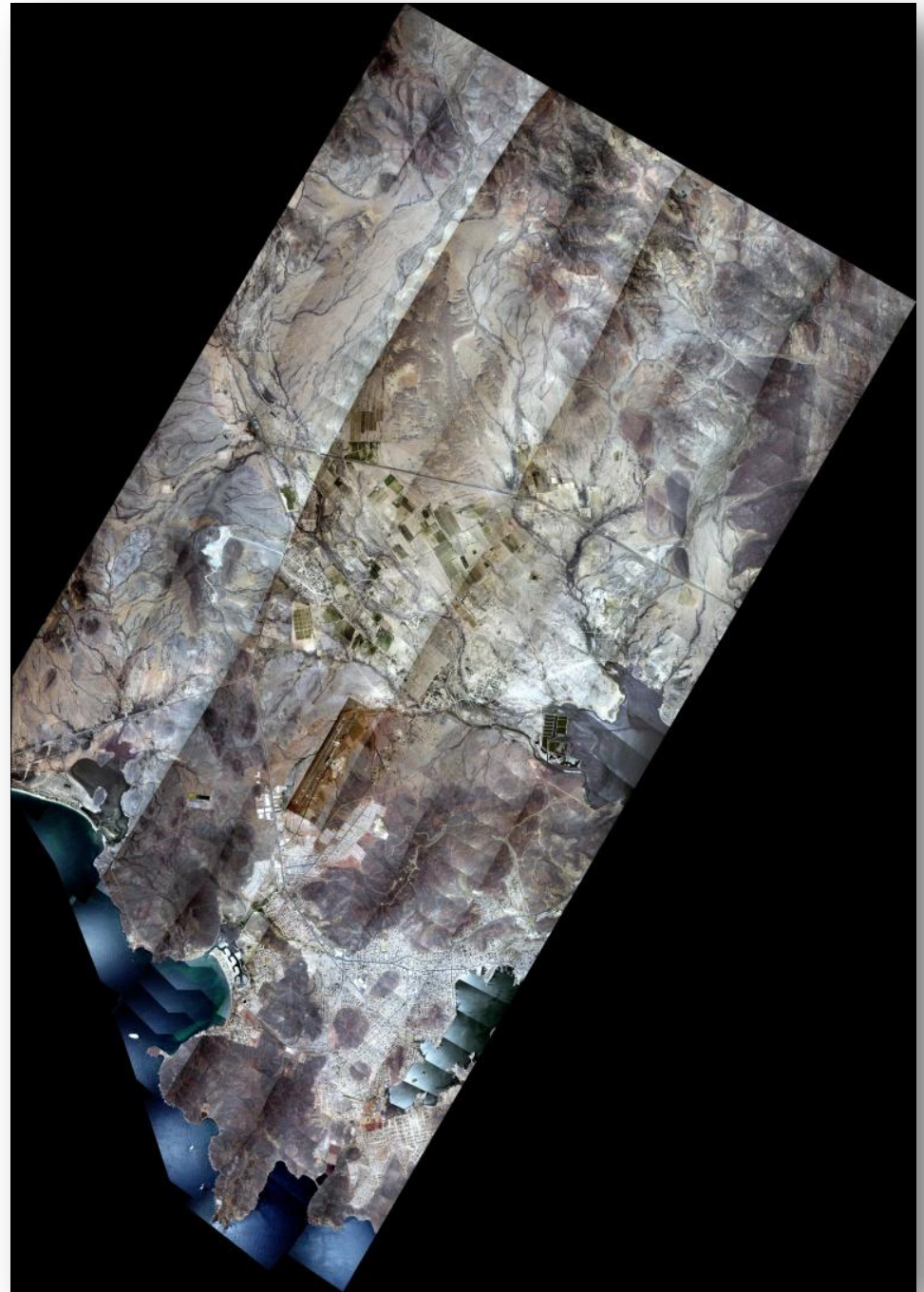
The establishment and development of National SDIs in each of the member countries;

The exchange of spatial information among all members of the community of the Americas (respecting each country's autonomy, but acting in accordance with the overarching laws and policies).

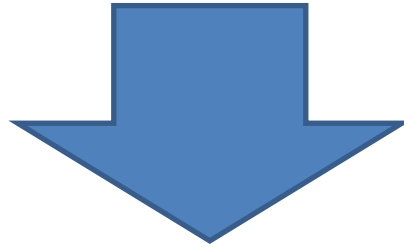


HISTORY

The encouragement of cooperation, research and exchange of experiences in the areas of knowledge related to the field of geomatics.



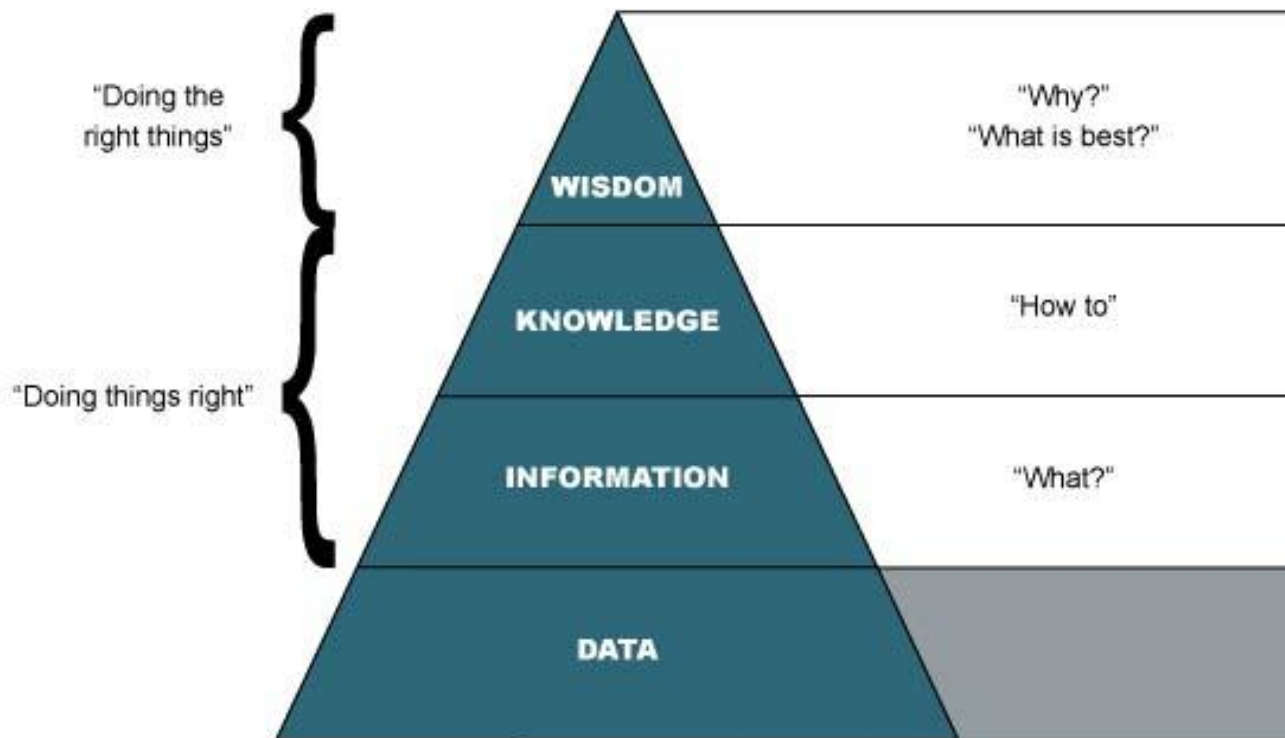
Significance of GI, GIS, and SDI in decision making processes.



Data, Information, Knowledge and Wisdom



DIKW model



Data, Information, Knowledge and Wisdom

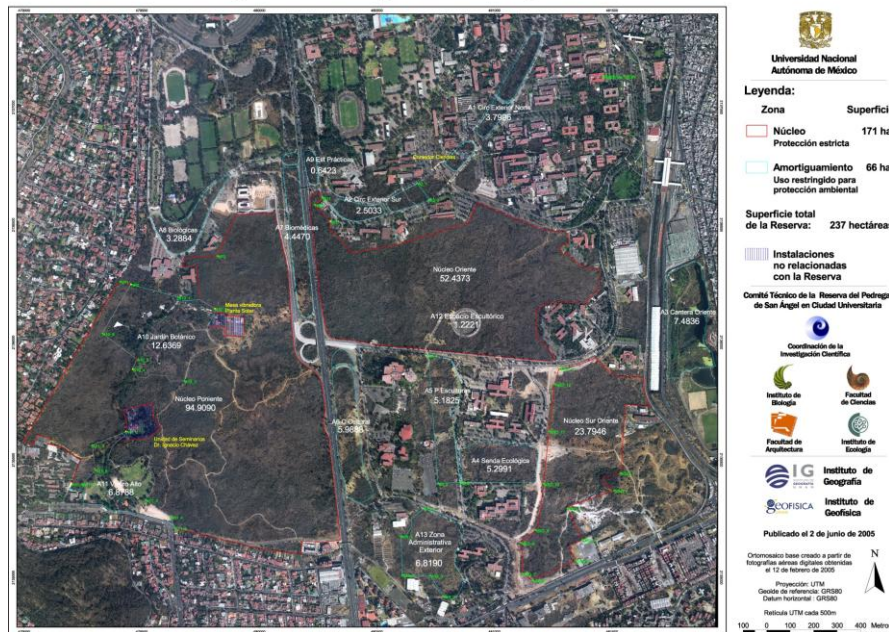
- Data concept, is in the basic level.
- Information requires considering certain class of context or intention.
- Knowledge implies a clear notion about relationship between diverse information groups.
- Wisdom requires to add the notion of what for? This data is going to be used to solve a complex situation.



Data, Information, Knowledge and Wisdom

- Knowledge answers to the questions how? And why?
- Information is getting significance through interpretation, and it is converted to knowledge.

Reserva Ecológica del Pedregal de San Ángel en Ciudad Universitaria



- In the geographic field, knowledge can be seen as the combination of data and information with the added opinion, abilities and the experience of a transdisciplinary group of experts.
- Giving a very valuable active that could be applied in decision making.



Data, Information, Knowledge and Wisdom

Wisdom then, requires necessarily of the abilities to see consequences of decision in the long term.

There is an special tool that can be used to improve wisdom



SPATIAL DATA INFRASTRUCTURES



Improve decision making processes in local, national, regional, and global scales.

