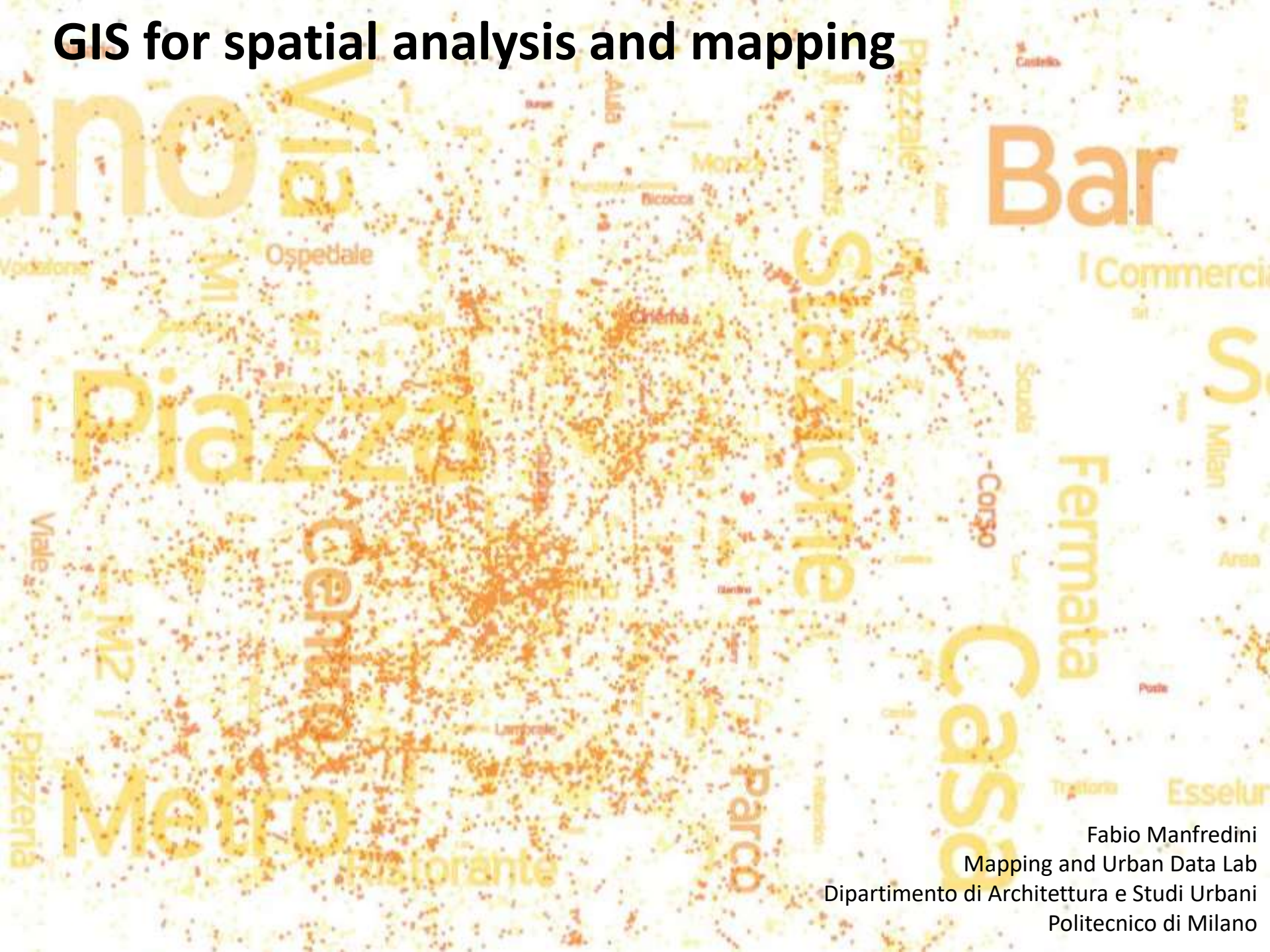
GIS for spatial analysis and mapping



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Politecnico di Milano

GIS and the geospatial revolution

This Geospatial Revolution has resulted in the development of consumer GPS tools, interactive web maps, and location-aware mobile devices. These radical advances are making it possible to use, collect, and understand spatial information like never before.

- **Global Positioning Systems, GPS**

  a device that is capable of receiving information from GPS satellites and then to accurately calculate its geographical location. The Global Positioning System (GPS) is a global navigation satellite system (GNSS)

- **Remote Sensing, RS**

  Remote sensing is the science of obtaining information about objects or areas from a distance, typically from aircraft or satellites.

- **Geographic Information Systems, GIS**

- **Crowdsourced information**

GIS

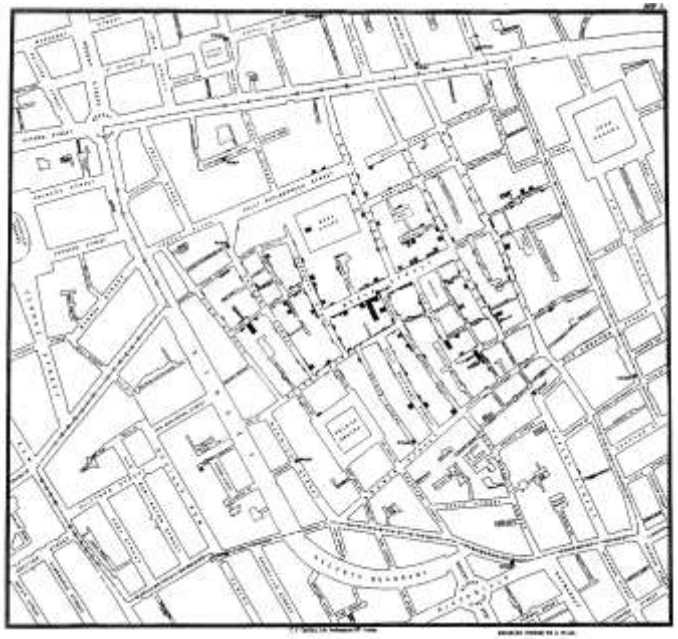
A geographic information system or GIS integrates data, hardware, software to assist in the analysis and display of geographically referenced information.

The key word to this technology is Geography –some portion of the data is spatial. In other words, data that is in some way **referenced to locations** on the earth. Coupled with this data is usually tabular data known as attribute data.

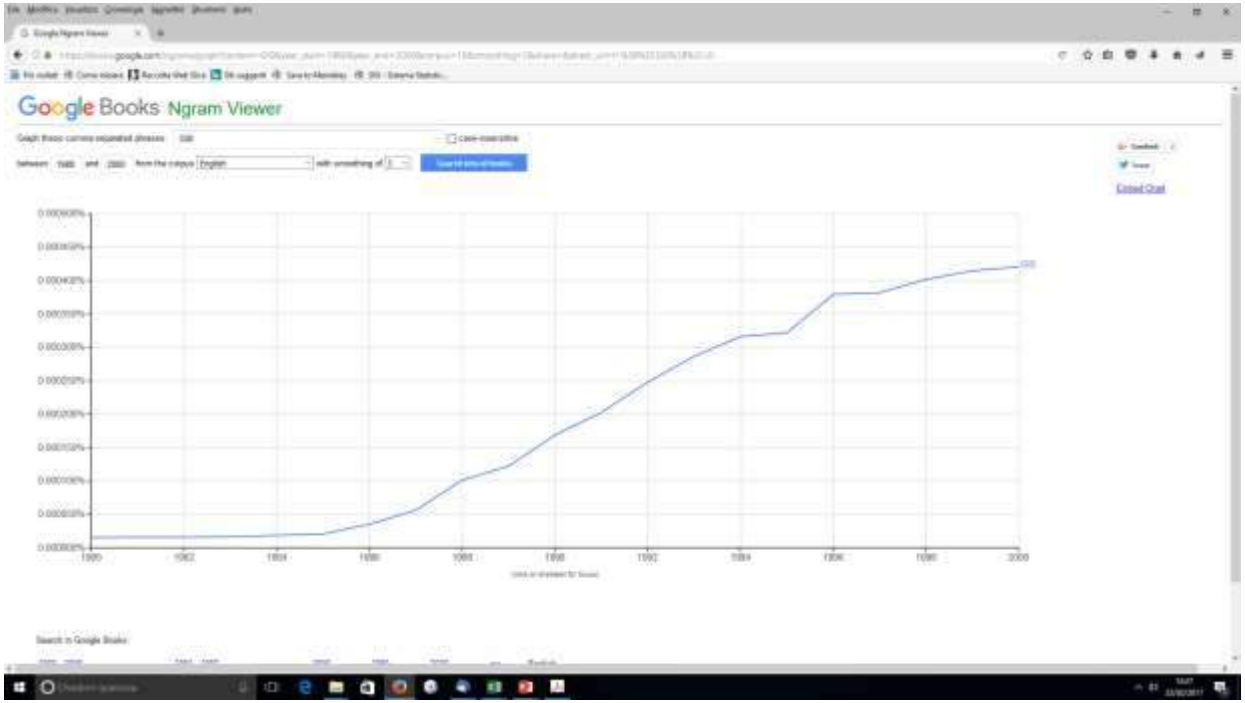
GIS collect , organize, elaborate and visualize spatial information

GIS are not maps

Complex spatial operation
Huge dataset
Multi source data



Original map by John Snow showing the clusters of cholera cases in the London epidemic of 1854. The pump is located at the intersection of Broad Street and Cambridge Street.



Created in the 60s, in the early 90s, the use of GIS had already become popular.

GIS are only a component of geospatial technologies (geoweb)

Google Earth, Bing, Here,

web mapping – Mapbox, Carto, umap, …

Geodesign and data visualization

3d Model and simulation

Open data
Spatial Open data
Satellite images: Sentinel, Landsat,

VGI (Volunteered Geographic Information) - **Openstreetmap**

Yesterday

Only Proprietary Software

Not free data, available on physical support (CD-ROM)

Expensive hardware

Not easy to share

Stand alone use

Now

Proprietary Software and Open source software

Spatial Open data available

ICT and WEB 2.0, GEOWEB

Social networking sites (e.g. Foursquare, Twitter)

New geospatial technologies

Mobile technologies that couple location-based connectivity with cameras and other sensing systems.

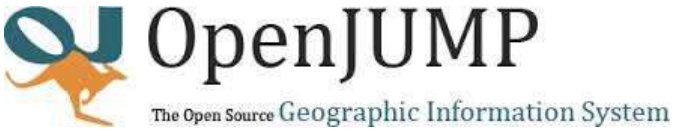
GIS programming language

Easy to share

Open source / Open source GIS

The program must include source code, and must allow distribution in source code as well as compiled form.
The **license** must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software.
Community of users and developers.

Quantum GIS: multiplatform, frequent releases, strong community of users
uDig: editing, visualizzazioni e analisi
OpenJump: editing e vector
WhiteBox: remote sensing
GRASS: model and analysis e analisi
SAGA: model and analysis e analisi



Proprietary GIS

Arcgis Desktop / Arcgis Online – Esri: full system for managing spatial data

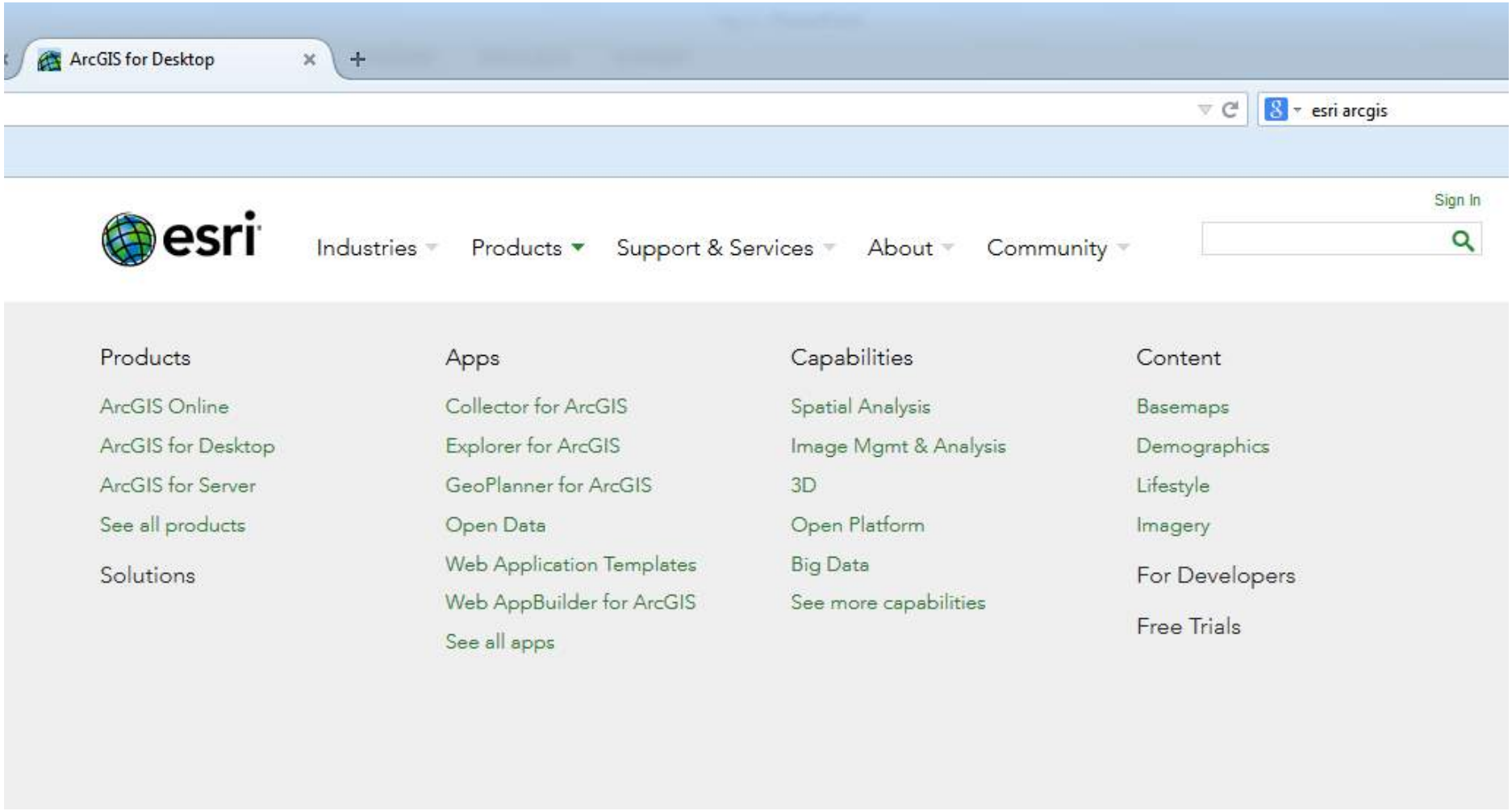
Geomedia – Intergraph: spatial analysis, spatial data infrastructure

AutoCAD map – Autodesk: CAD + GIS

Mapinfo – Mapinfo: vector + raster

Erdas – Erdas: satellite images

Arcgis



POLIMI has a full Arcgis license

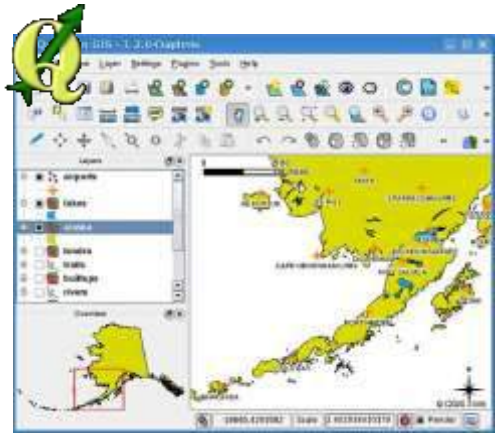
Proprietary and open source GIS

ESRI

AutocadMap

Mapinfo

Proprietary



http://www.qgis.org/

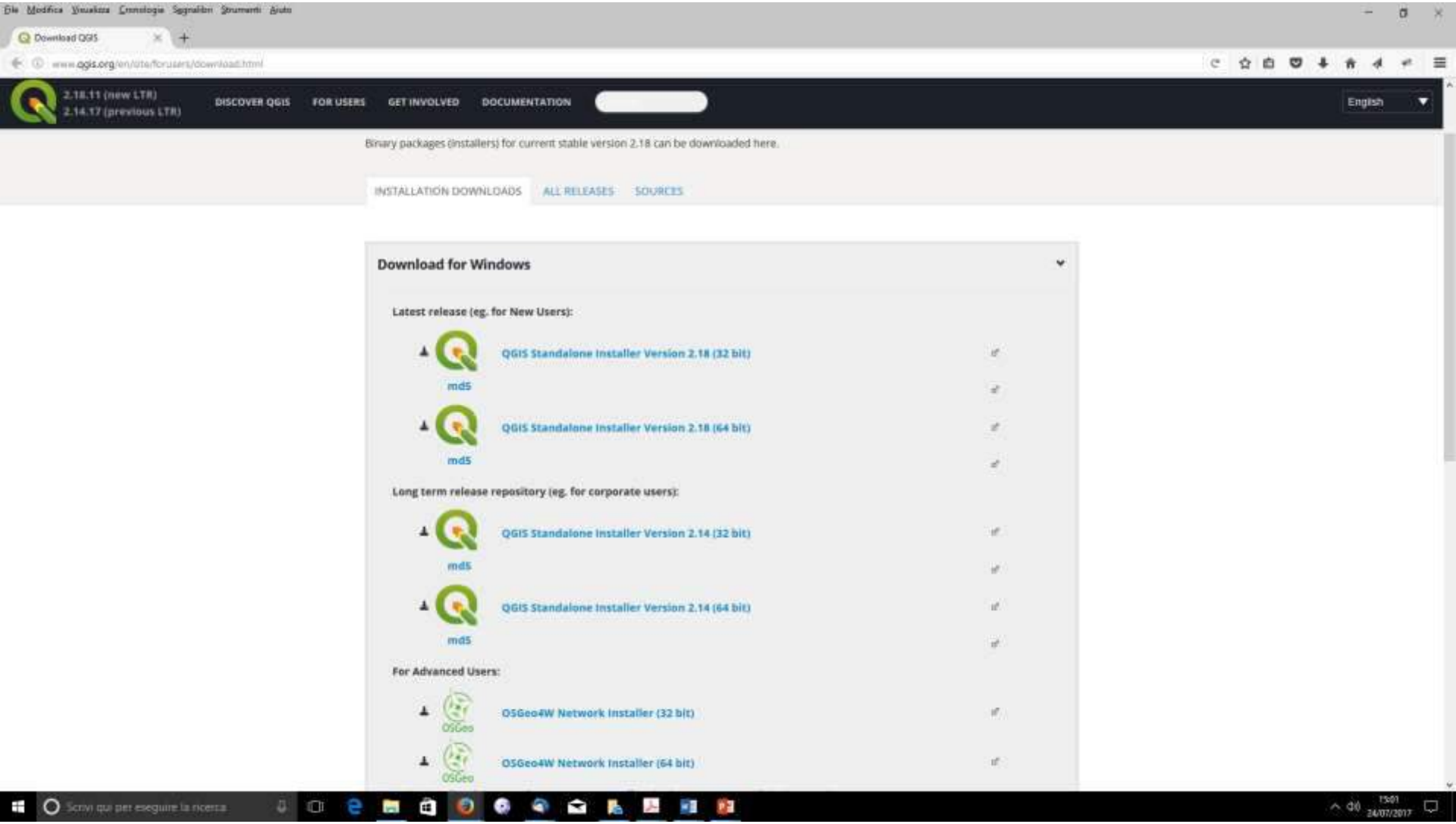
http://www.gvsig.org/

Open source

Proprietary and open source GIS: a comparison

Characteristic	Open Source	Proprietary
Cost	Low or no	High
Updates	Frequent	Less frequent than OS. Each new release -> high improvement
Manuals and documentation	Present but the quality and the completness depends on the community of users Forums available	Professional, books, website, manuals Forums available
Who realizes the software	Foundations, research centres	Private firm
Diffusion	Global	Global but concentrated in some countries
Strenghts	Possibility to integrate new functions, active community of users, price, functions, ….	Documentation, support, translations, functions, layout,…

http://www.qgis.org/en/site/



Version 2.18.24 LTR «Las Palmas»

Download and Install QGIS

Software download page:
http://www.qgis.org/en/site/forusers/download.html

Download for Windows

- Qgis Standalone Installer Version 2.18 (32 bit or a 64 bit a seconda del sistema operativo);

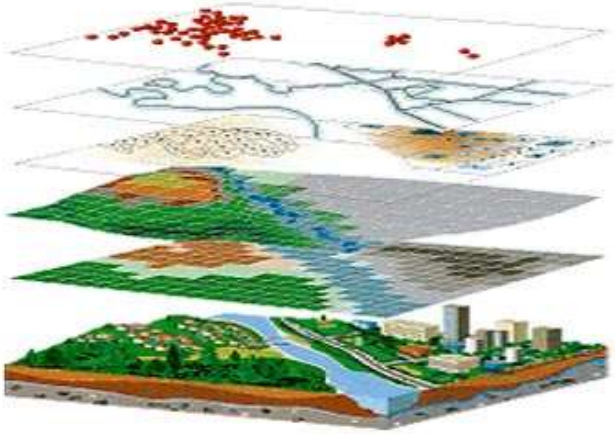
Download for Mac OS X - Mac Installer Package for both OS X Mavericks (10.9), Mountain Lion (10.8) and Lion (10.7):

- This version requires **separate installation of dependency framework (GDAL Complete)** http://www.kyngchaos.com/software/frameworks
- Download Qgis: http://www.kyngchaos.com/software/qgis

Download for Linux – GNU/Linux binary packages (rpm and deb) or software repositories are available.
http://www.qgis.org/en/site/forusers/alldownloads.html#linux

GIS data

GIS



http://www.izmo.it/Wikizmo/Articoli/Geographical_Information_Systems

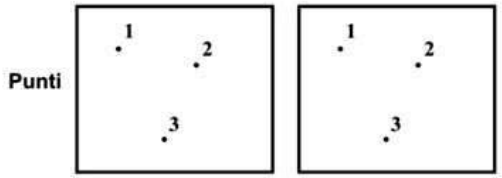
Geometry

Topology

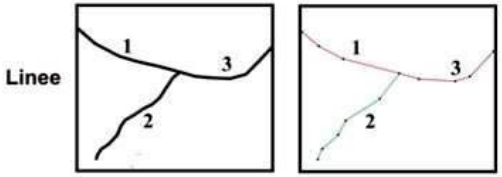
Attributes

Spatial data are georeferenced

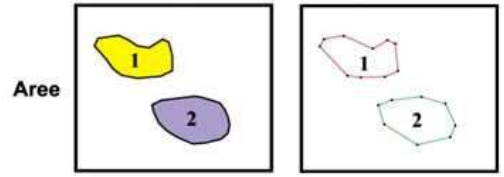
Vector



A **point** is defined by a single pair of coordinate values. A point normally represents a geographic feature that is too small to be represented as a line or area.

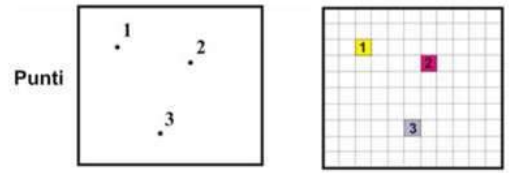


A **line** is defined by an ordered list of coordinate pairs defining the points through which the line is drawn.

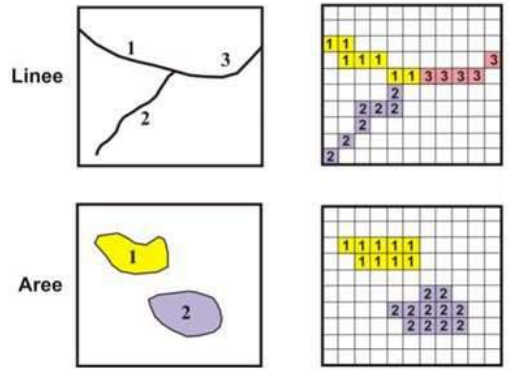


An **area** is defined by the lines that make up its boundary. Areas are also referred to as **polygons**.

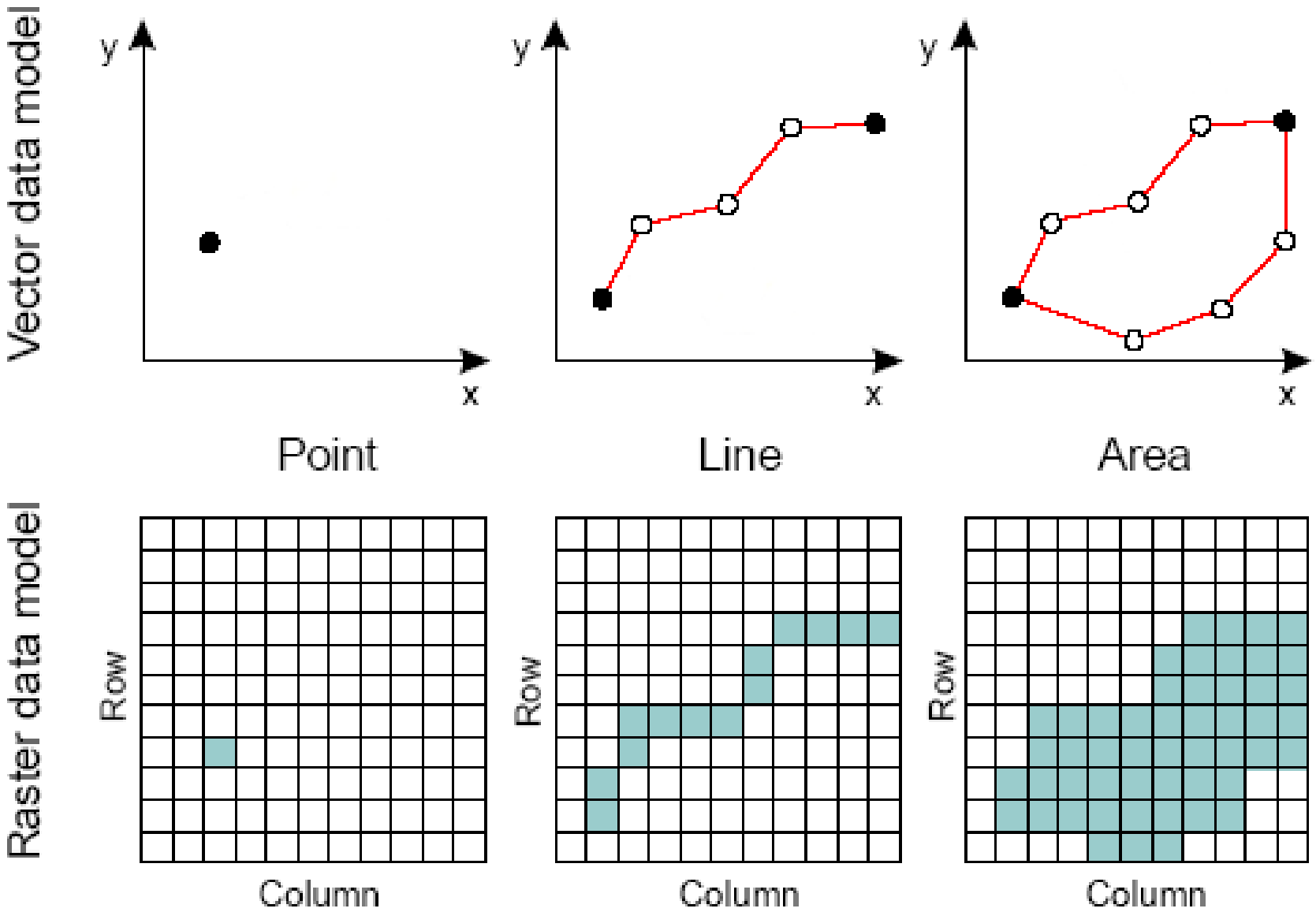
Raster



The raster data model is an abstraction of the real world where the basic unit of data (points, lines and areas) is represented using a matrix of cells or '**pixels**'.

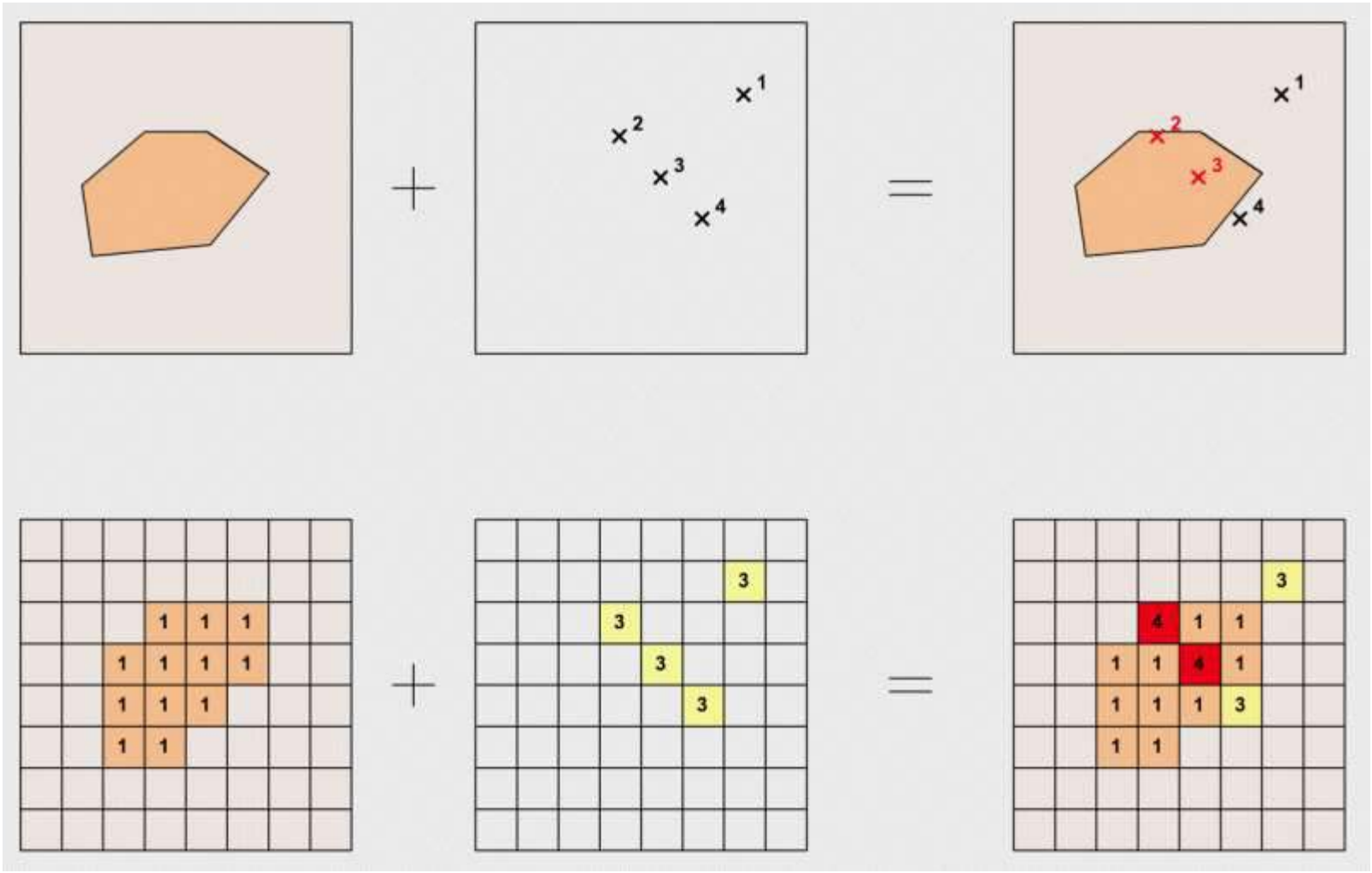


The raster model uses the grid-cell data structure where the geographic area is divided into cells identified by rows and columns.
The following information must be known when using raster data:
- grid extent (number of rows and columns)
- grid resolution (size of grid cell)
- georeferencing information (e.g. corner coordinates)



http://www.catalonia.org/cartografia/Clase_03/Raster_Vector.html

Vector vs Raster

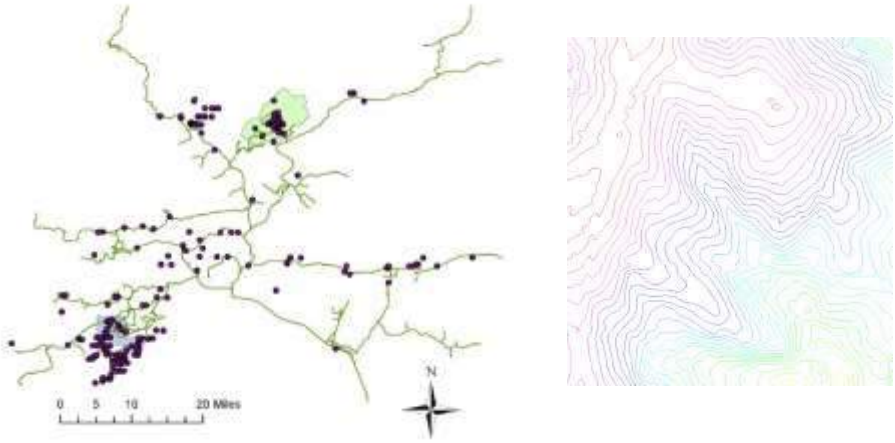


Qgis data

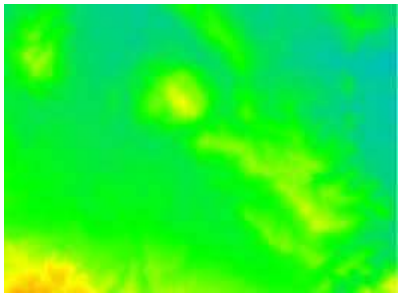
1. **GDAL** - Geospatial Data Abstraction Library **Vector and raster**

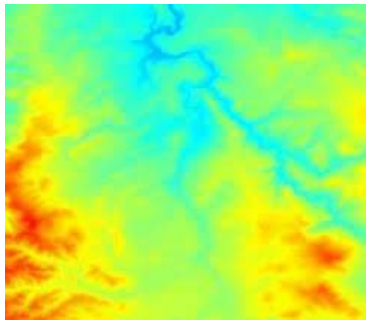
GDAL is a translator library for raster and vector geospatial data formats that is released under an X/MIT style Open Source license by the Open Source Geospatial Foundation. As a library, it presents a single raster abstract data model and vector abstract data model to the calling application for all supported formats. Traditionnaly GDAL used to design the raster part of the library, and OGR the vector part for Simple Features. Starting with GDAL 2.0, both sides have been more tightly integrated.

Vector



Raster



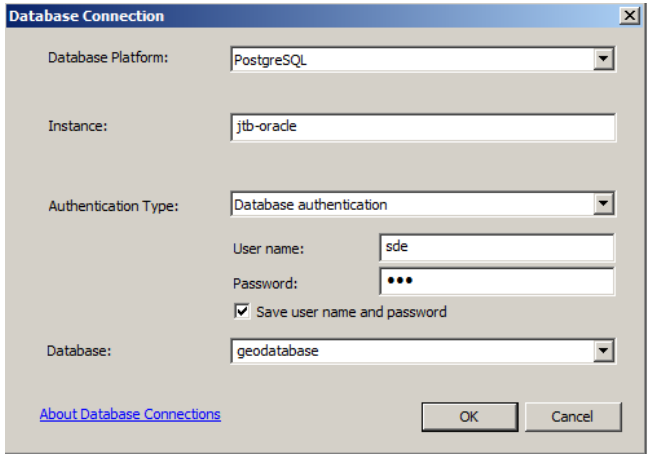


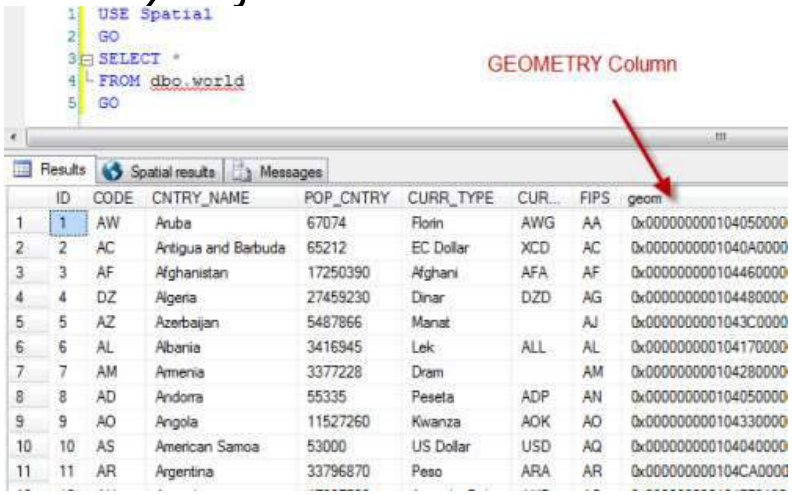
Qgis data

2. Spatial database - vector

POSTGIS
Spatialite
MSSQL
Oracle
Oracle Georaster
SQL Anywhere

A **spatial database** is a [database](#) that is optimized to store and query data that represents objects defined in a geometric space. Most spatial databases allow representing simple geometric objects such as points, lines and polygons. While typical databases are designed to manage various numeric and character types of data, additional functionality needs to be added for databases to process spatial data types efficiently. These are typically called *geometry* or *feature*.





	ID	CODE	CNTRY_NAME	POP_CNTRY	CURR_TYPE	CUR...	FIPS	geom
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2	2	AC	Antigua and Barbuda	65212	EC Dollar	XCD	AC	0x0000000001040A0000
3	3	AF	Afghanistan	17250390	Afghani	AFA	AF	0x0000000001044600000
4	4	DZ	Algeria	27459230	Dinar	DZD	AG	0x0000000001044800000
5	5	AZ	Azerbaijan	5487866	Manat		AJ	0x0000000001043C0000
6	6	AL	Albania	3416945	Lek	ALL	AL	0x0000000001041700000
7	7	AM	Armenia	3377228	Dram		AM	0x0000000001042800000
8	8	AD	Andorra	55335	Peseta	ADP	AN	0x0000000001040500000
9	9	AO	Angola	11527260	Kwanza	AOK	AO	0x0000000001043300000
10	10	AS	American Samoa	53000	US Dollar	USD	AQ	0x0000000001040400000
11	11	AR	Argentina	33796870	Peso	ARA	AR	0x000000000104CA0000

Qgis data

3. Wep map services

WMS

The Open Geospatial Consortium (OGC), Web Map Service (WMS) specification is an international specification for serving and consuming dynamic maps on the web.
A WMS server usually serves the map in a bitmap format, e.g. PNG, GIF or JPEG.

WFS

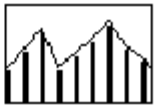
The Open Geospatial Consortium (OGC), **Web Feature Service** (**WFS**) provides an interface allowing requests for geographical features across the web using platform-independent calls. Unlike the OGC Web Map Service (WMS), which returns an image of a map, the WFS service returns actual features with geometry and attributes that clients can use in any type of geospatial analysis.

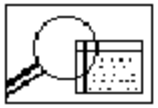
4. Text file tables

A delimited text file is a tabular data with each column separated by a defined character and each row separated by a line break. The first row usually contains the column names. A common type of delimited text file is a CSV (Comma Separated Values), with each column separated by a comma. Such data files can also contain positional information.

GIS functions

Search:

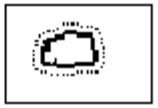

Interpolation


Thematic Search


Spatial Search

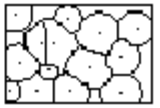

(Re-)classification

Location Analysis:


Buffer


Corridor


Overlay


Thiessen/Voronoi

Terrain Analysis:

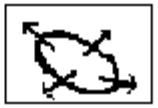
Slope/Aspect

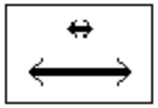

Catchment/Basins

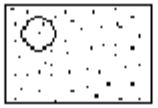

Drainage/Network


Viewshed Analysis

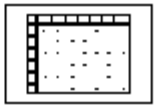
Distribution/
Neighborhood:

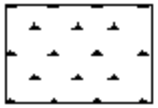

Cost/Diffusion/Spread

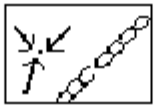

Proximity

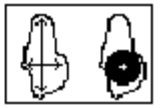

Nearest Neighbor

Spatial Analysis:

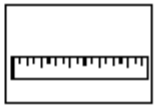

Multivariate Analysis


Pattern/Dispersion


Centrality/Connectedness


Shape

Measurements:


Measurements

Address geocoding, Network Analysis, ….

GIS outupts

General-purpose maps

Topographic Map

Thematic maps

Dot Density Map

Isoline (Isarithmic) Map

Graduated Symbol Map

Choropleth Map (Graduated Color)

Density Map

……

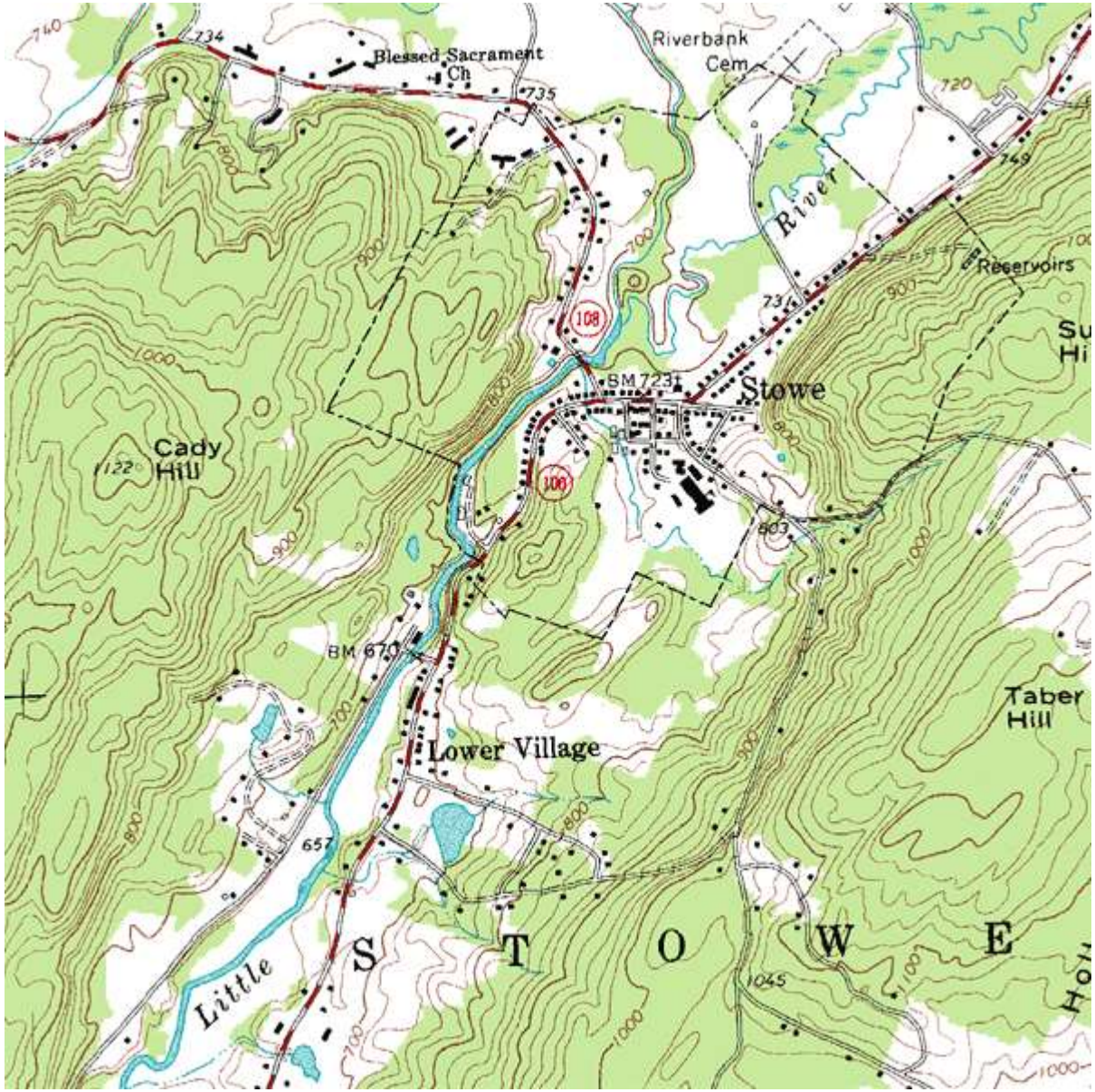
Statistics

Graph

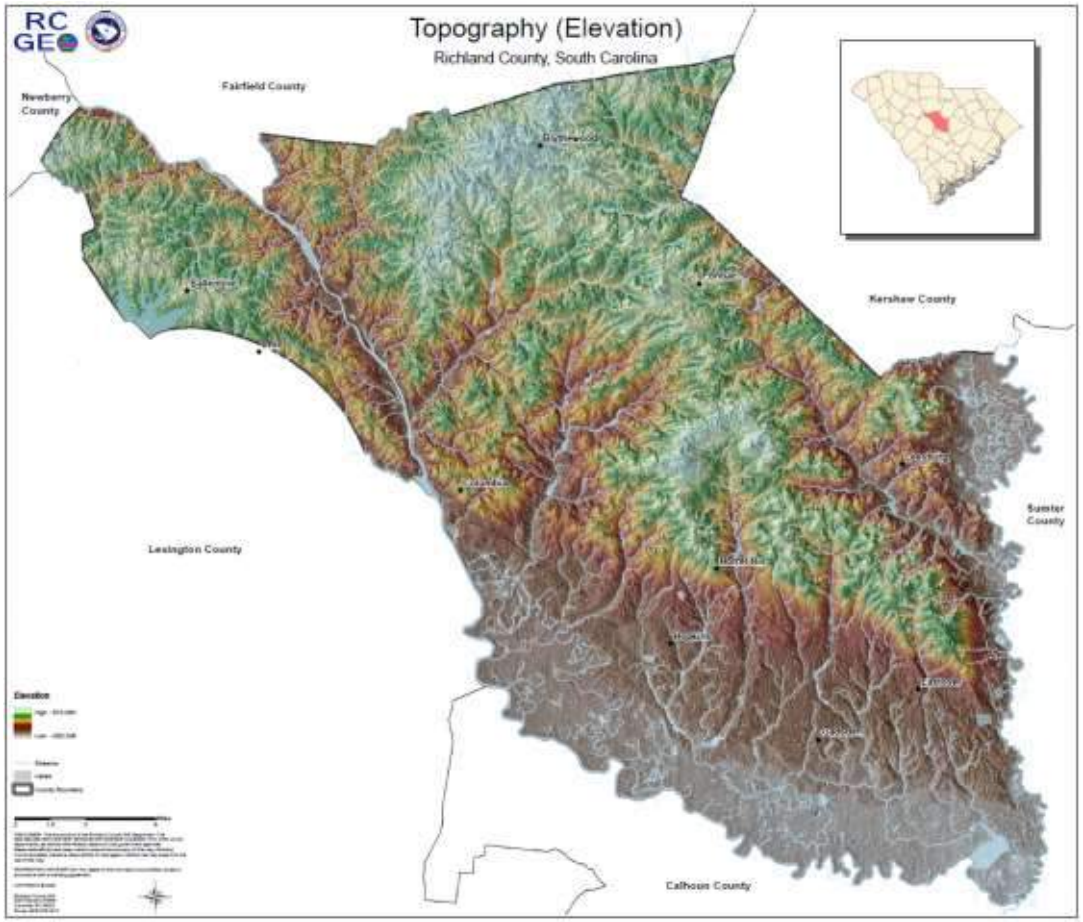
Reports

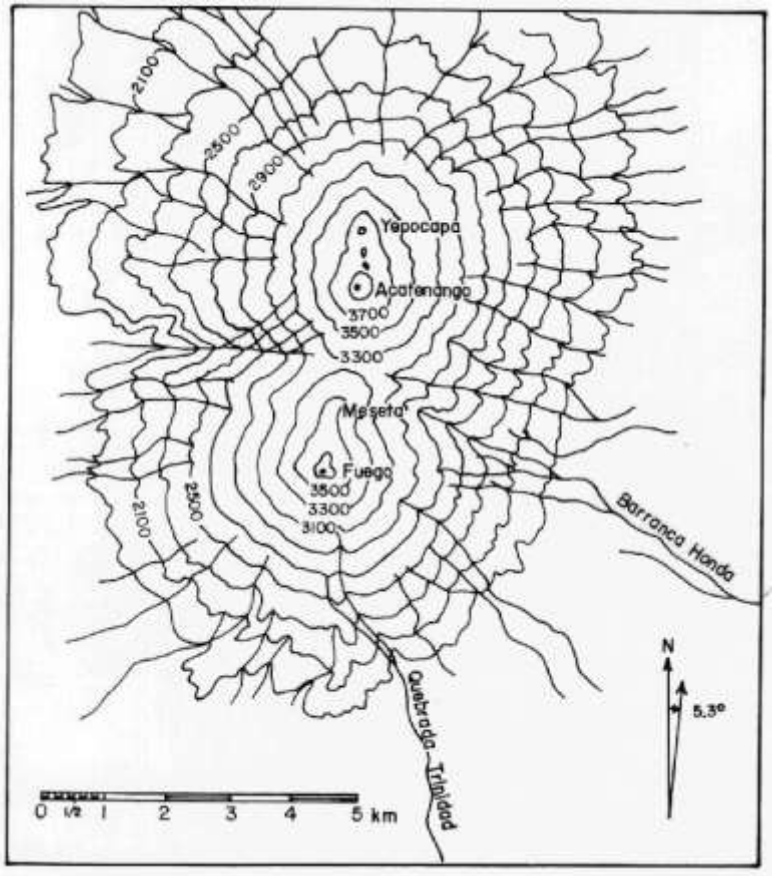
Webmap …..

GIS outputs: examples

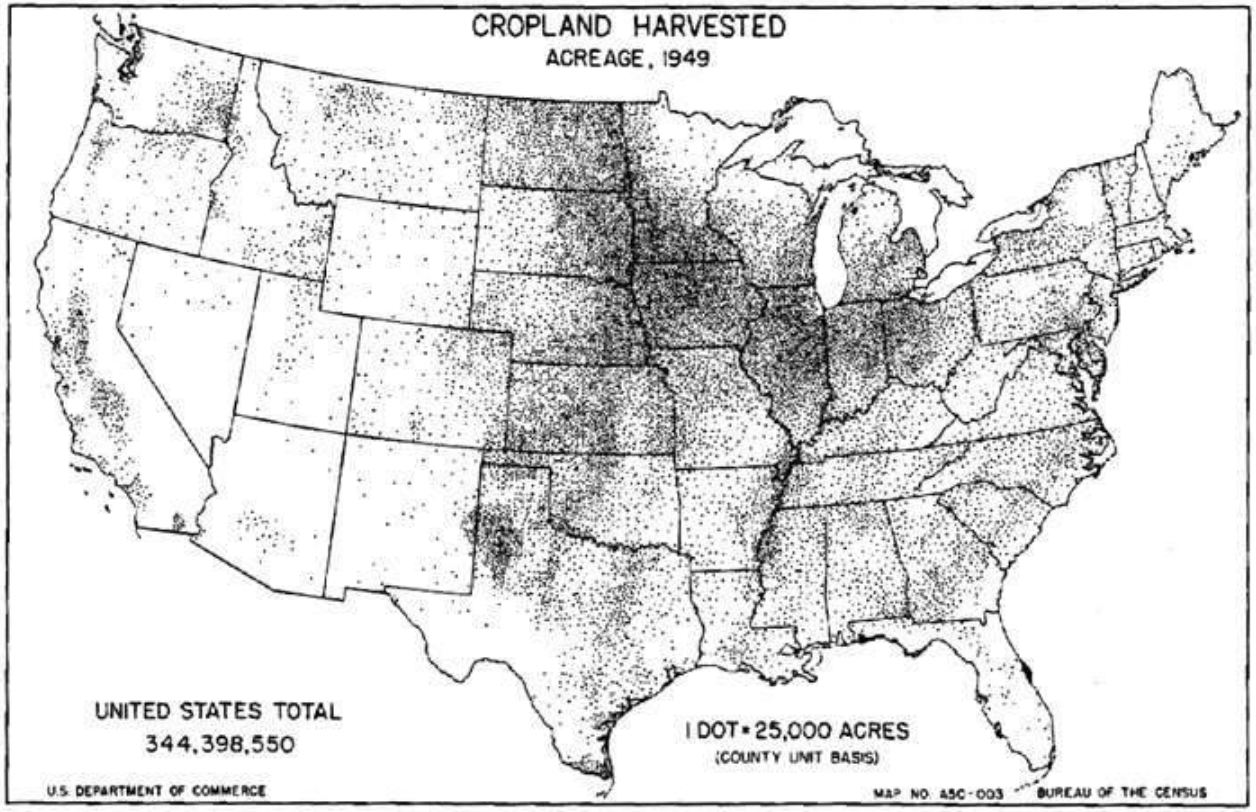


Topographic map





Elevation map: raster / vector



Source: US Department of Commerce

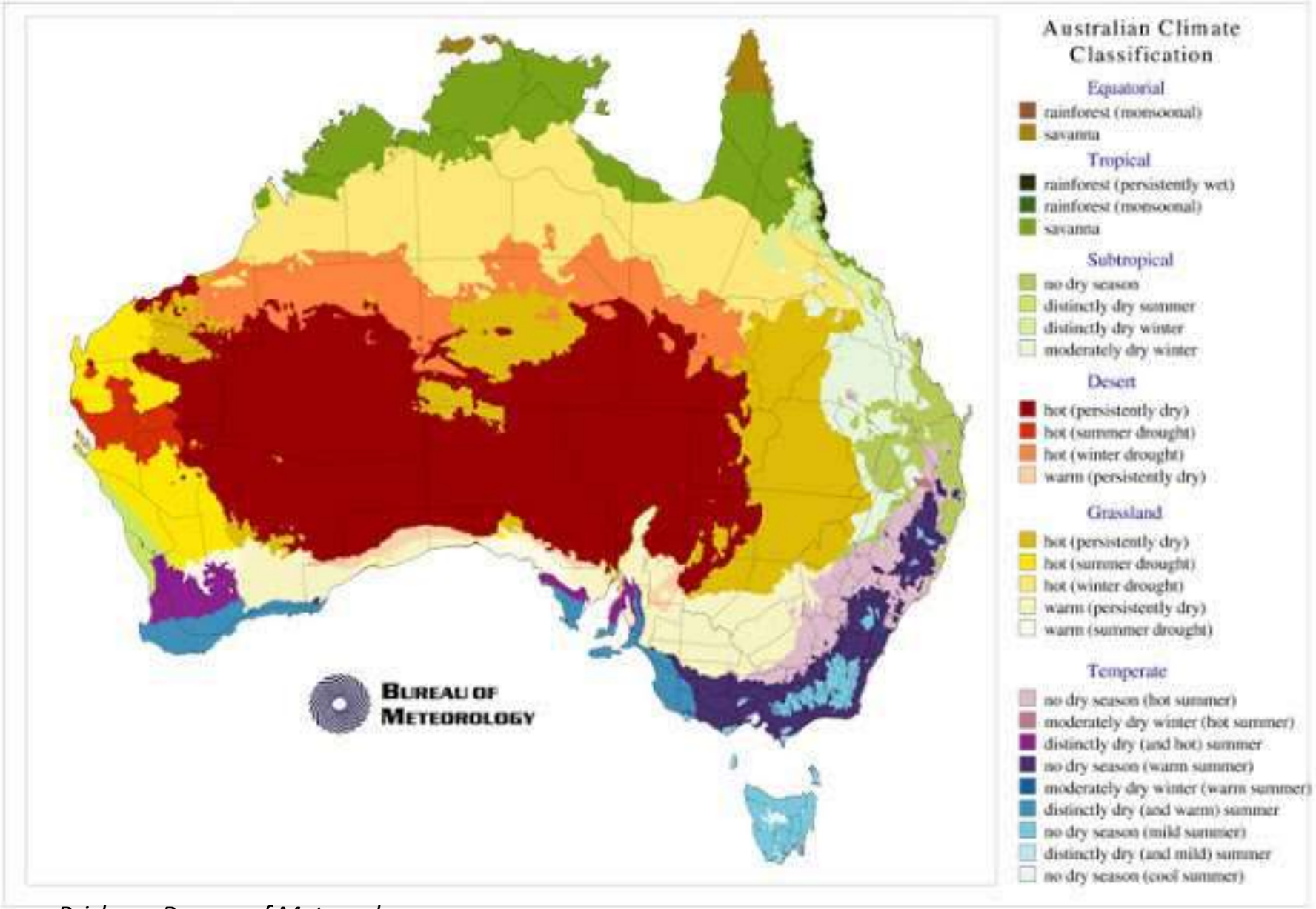
10 people

100 people

500 people

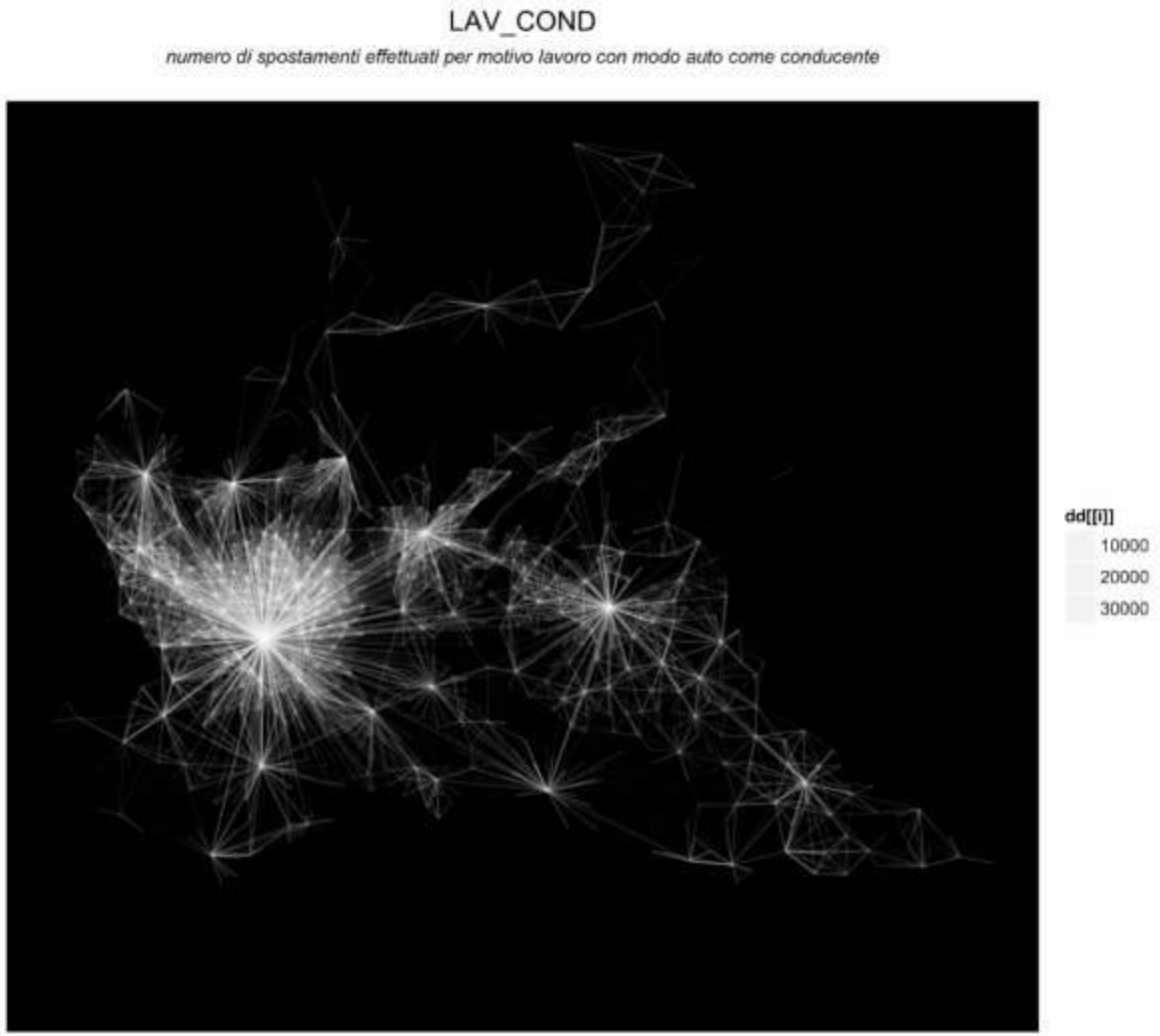
1 dot represents two people.

Dot density map



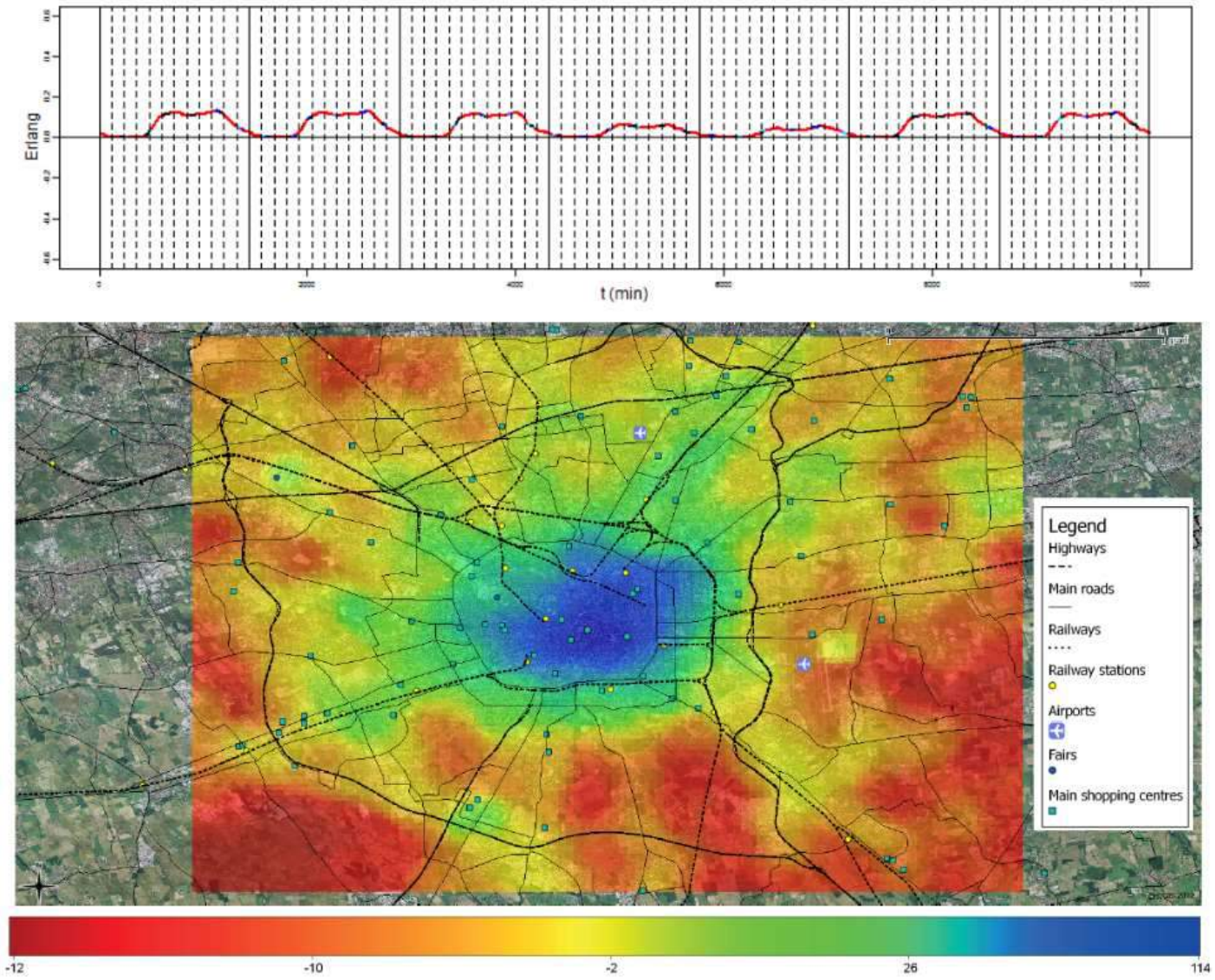
Source: Brisbane Bureau of Meteorology

Thematic map



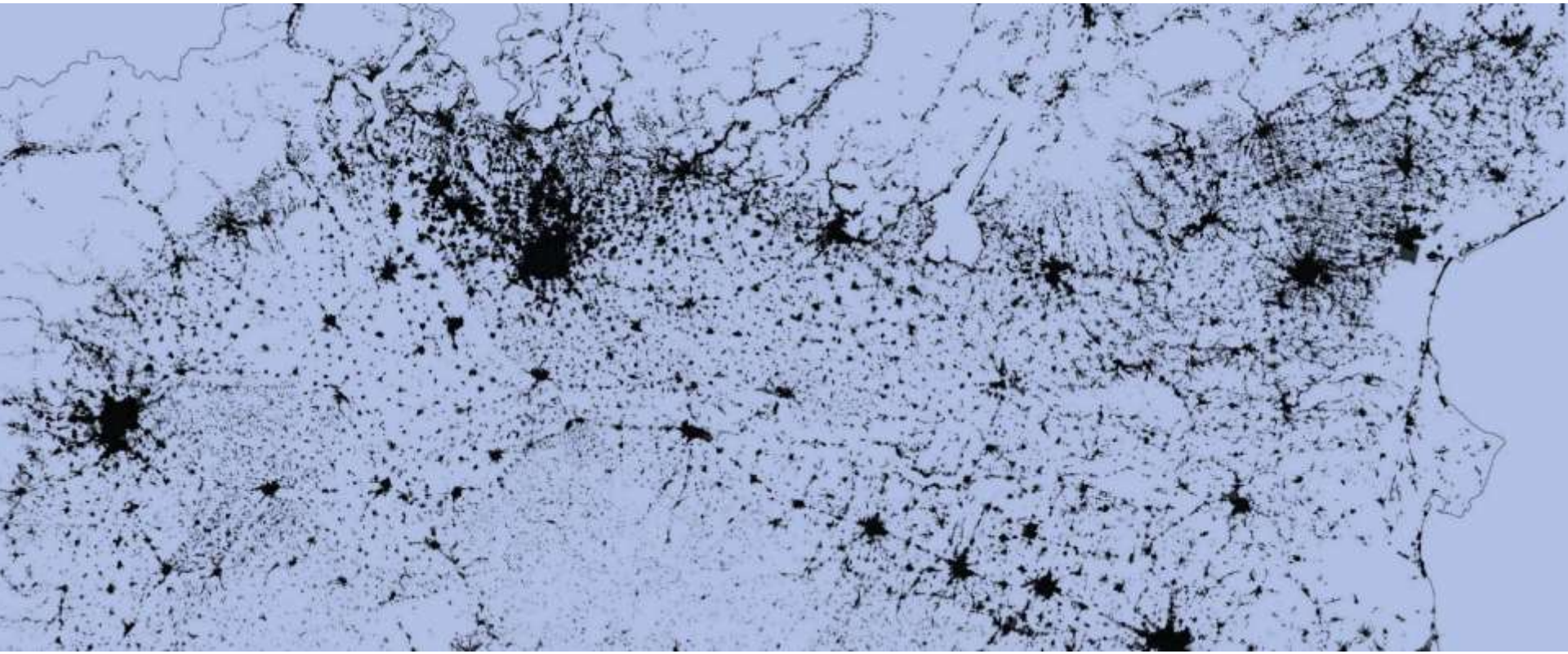
Source: Ferretti, 2015

Flow map



Source: Manfredini et al., 2013

Intensity map



Source: Prin 2010

Thematic map: urbanization processes in Northern Italy

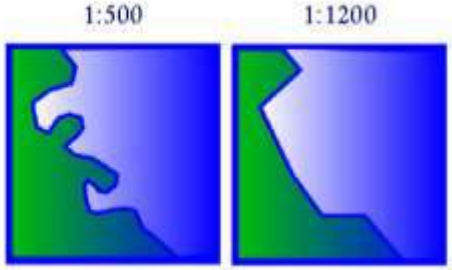
GEOSPATIAL INNOVATION FACILITY

Cutting-Edge Mapping Technology at UC Berkeley

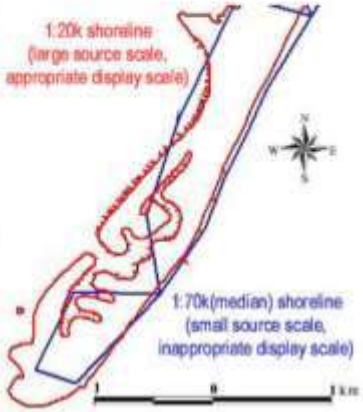
WHAT IS SCALE?

Scale is the scale represents the relationship of the distance on the map/data to the actual distance on the ground.

- Map detail is determined by the source scale of the data: the finer the scale, the more detail.
- Source scale is the scale of the data source (i.e. aerial photo or satellite image) from which data is digitized (into boundaries, roads, landcover, etc. in a GIS).
- In a GIS, zooming in on a small scale map does *not* increase its level of accuracy or detail.
- **Rule of thumb**: Match the appropriate scale to the level of detail required in the project.

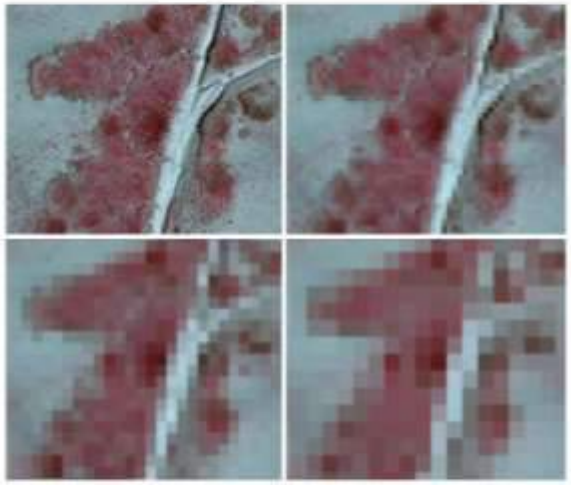


Above, right. Comparing fine and coarse source scales shows how the level of detail in the data is determined by the spatial scale of the source data.



SPATIAL SCALE

Spatial scale involves *grain* & *extent:*
Grain: the size of your pixel & the smallest resolvable unit.
Extent: the size of your study area & the largest resolvable unit.



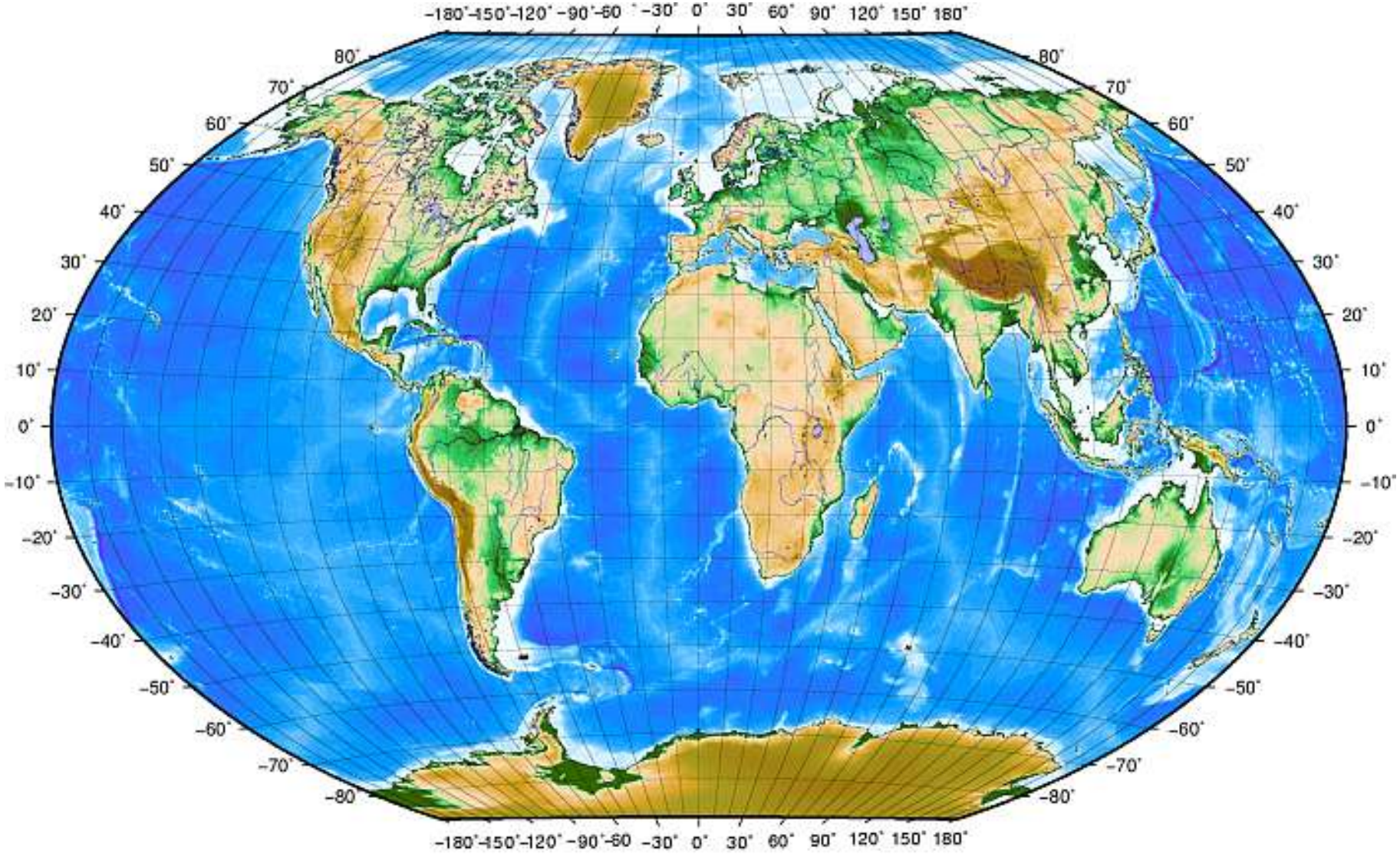
Left. This series of pictures shows a section of wetland at progressively bigger grain sizes.

The more detail the better; however, more detail requires more computer power.

You can also make grain size larger, but you can never make it smaller.

Common grain sizes:

- 30m – Landsat satellite imagery
- 30m, 10m – USGS quad digital elevation models (DEMs)
- 4m, 1m – IKONOS satellite imagery
- 1m – 2005 National Agricultural Imagery Program (NAIP) photos
- 8ft, 2ft – Quickbird satellite imagery
- 1ft – USGS 2004 color aerial photography

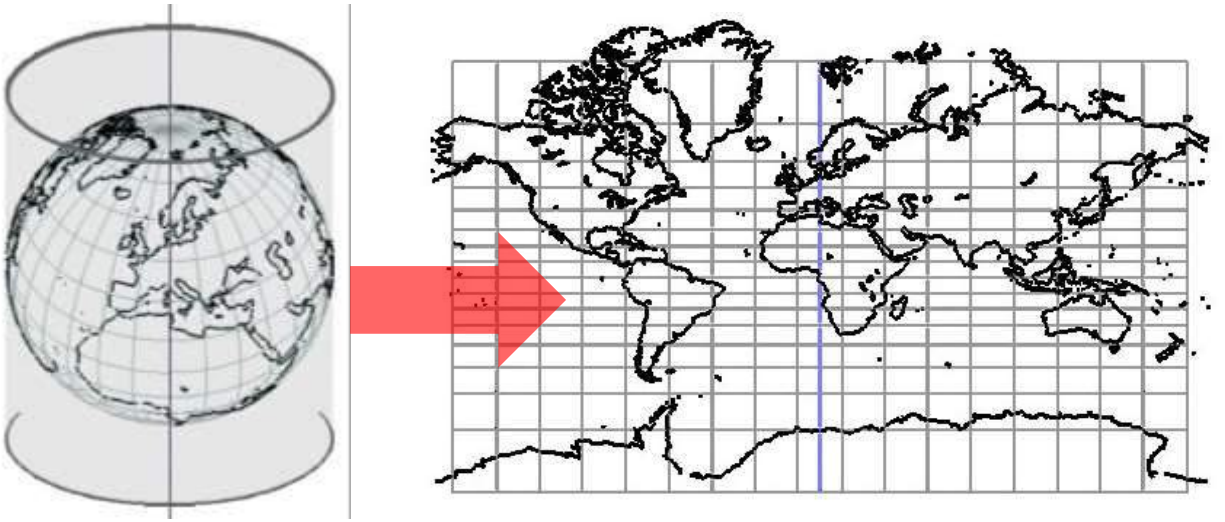


The use of Geographic Coordinate Reference Systems is very common. They use degrees of latitude and longitude and sometimes also a height value to describe a location on the earth's surface. The most popular is called **WGS 84**.

Universal Transverse Mercator (UTM)

The Universal Transverse Mercator (UTM) conformal projection uses a 2-dimensional Cartesian coordinate system. Like the traditional method of latitude and longitude, it is a horizontal position representation, i.e. it is used to identify locations on the Earth independently of vertical position.

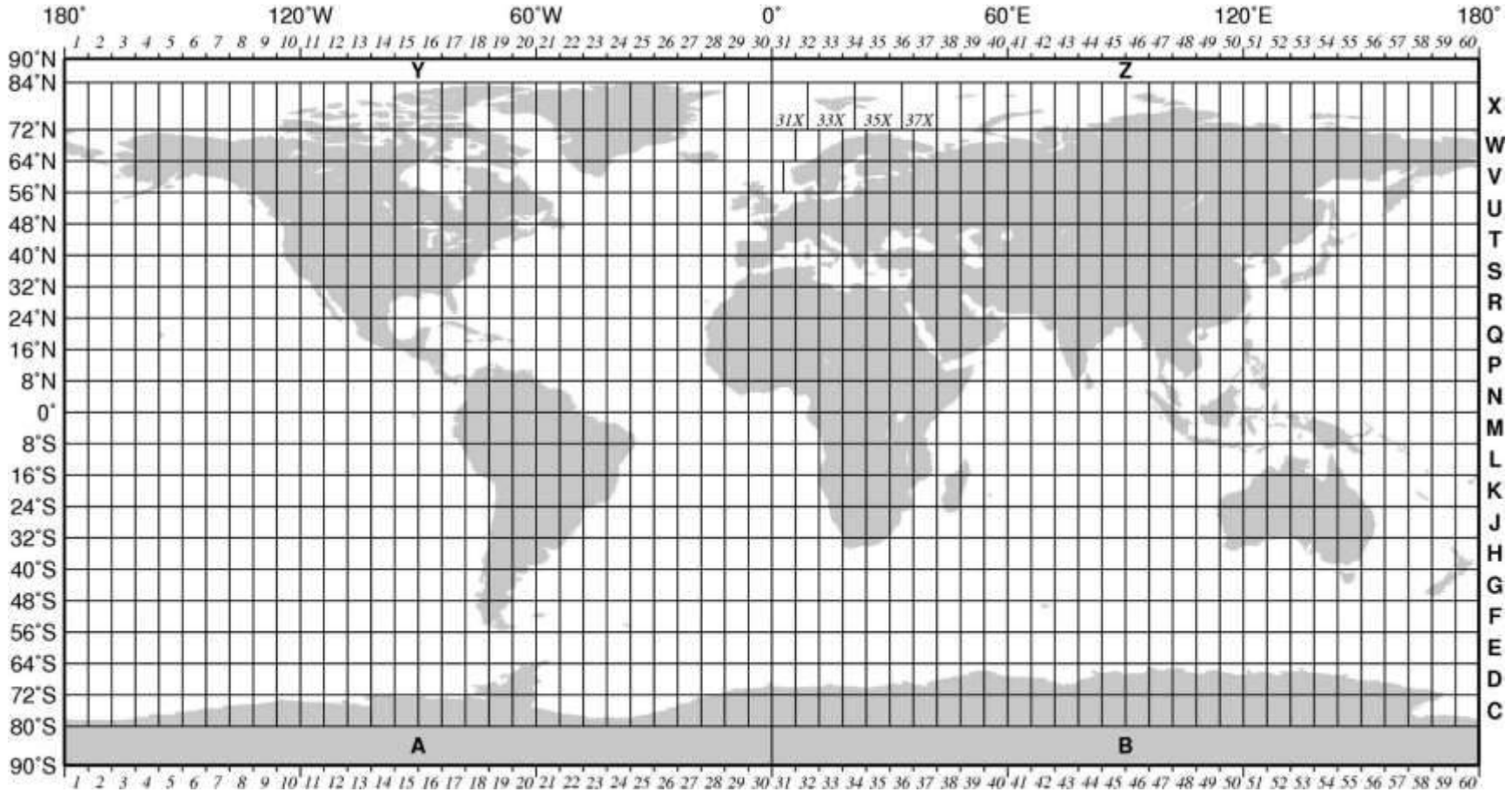
The UTM system is not a single map projection. The system instead divides the Earth into sixty zones, each being a six-degree band of longitude, and uses a secant transverse Mercator projection in each zone.



Datum **Projection**

WGS 84/UTM zone 32N

(EPSG 32632)



The globe is divided into 60 zones between 84°S and 84°N, most of which are 6° wide. Each of these UTM zones have their unique central meridian. Furthermore, each zone is divided into latitude bands

Qgis: coordinate reference system

QGIS allows users to define a global and project-wide CRS (coordinate reference system) for layers without a pre-defined CRS. It also allows the user to define custom coordinate reference systems and supports on-the-fly (OTF) projection of vector and raster layers. All of these features allow the user to display layers with different CRSs and have them overlay properly.

QGIS has support for approximately 2,700 known CRSs. The CRSs available in QGIS are based on those defined by the European Petroleum Search Group (EPSG) and the Institut Geographique National de France (IGNF) and are largely abstracted from the spatial reference tables used in GDAL. EPSG identifiers are present in the database and can be used to specify a CRS in QGIS.

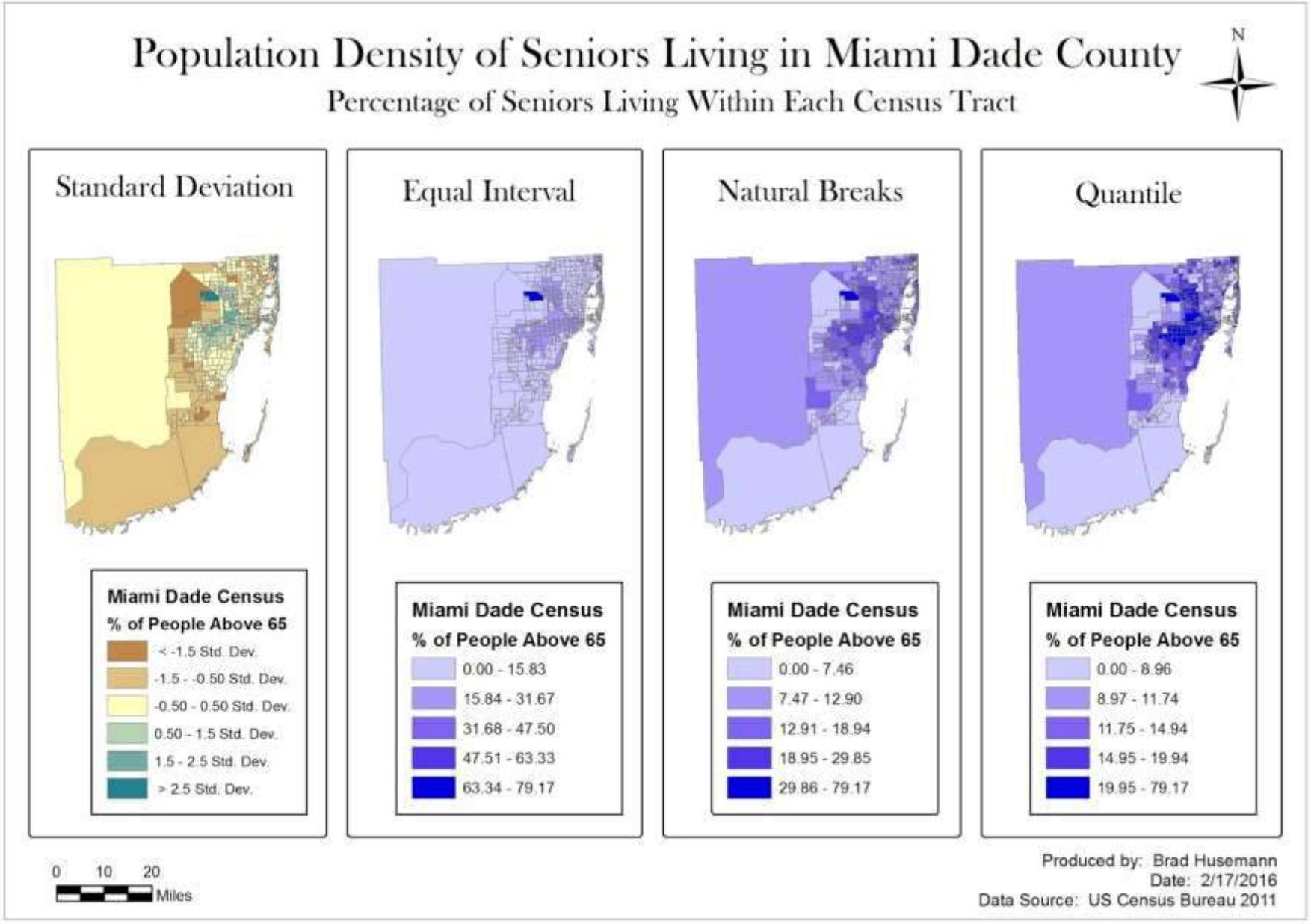
The EPSG Geodetic Parameter Dataset is a structured dataset of Coordinate Reference Systems and Coordinate Transformations, accessible through this online registry (www.epsg-registry.org) or, as a downloadable zip files, through IOGP's EPSG home page at www.epsg.org. The geographic coverage of the data is worldwide, but it is stressed that the dataset does not and cannot record all possible geodetic parameters in use around the world. The EPSG Geodetic Parameter Dataset is maintained by the Geodesy Subcommittee of IOGP's Geomatics Committee.

Geographic coordinate system
EPSG:4326 - WGS 84

Projected coordinate system
EPSG: 32636 WGS84/UTM zone 32N
EPSG: 3003 Monte Mario / Italy zone 1

EPSG: 3857 – WGS 84 / Pseudo Mercator
Used by certain Web mapping and visualization applications. Uses spherical development of ellipsoidal coordinates. Relative to an ellipsoidal development errors of up to 800 meters in position and 0.7 percent in scale may arise. It is not a recognized geodetic system
http://spatialreference.org/

Related issue: data classification



On line data sources

1. Internet diffusion
    - Increase of velocity
    - Increase of traffic volume
    - Data archive
    - Easy access to data, Easy sharing of data
2. Open Data initiative:

    Open data is data that can be freely used, re-used and redistributed by anyone - subject only, at most, to the requirement to attribute and sharealike.

    - Governments
    - Regions
    - Public institutions, Agencies
    - Municipalities
    - Private sector (?)
    - Etc.
    - Spatial Open data (with coordinates or in geographic format)

On line data sources

Global Land Cover Facility.
http://www.landcover.org/

European Environmental Agency
http://www.eea.europa.eu/data-and-maps

Gisco - Geographic Information System of the European Commission
http://ec.europa.eu/eurostat/web/gisco

On line data sources: Italy

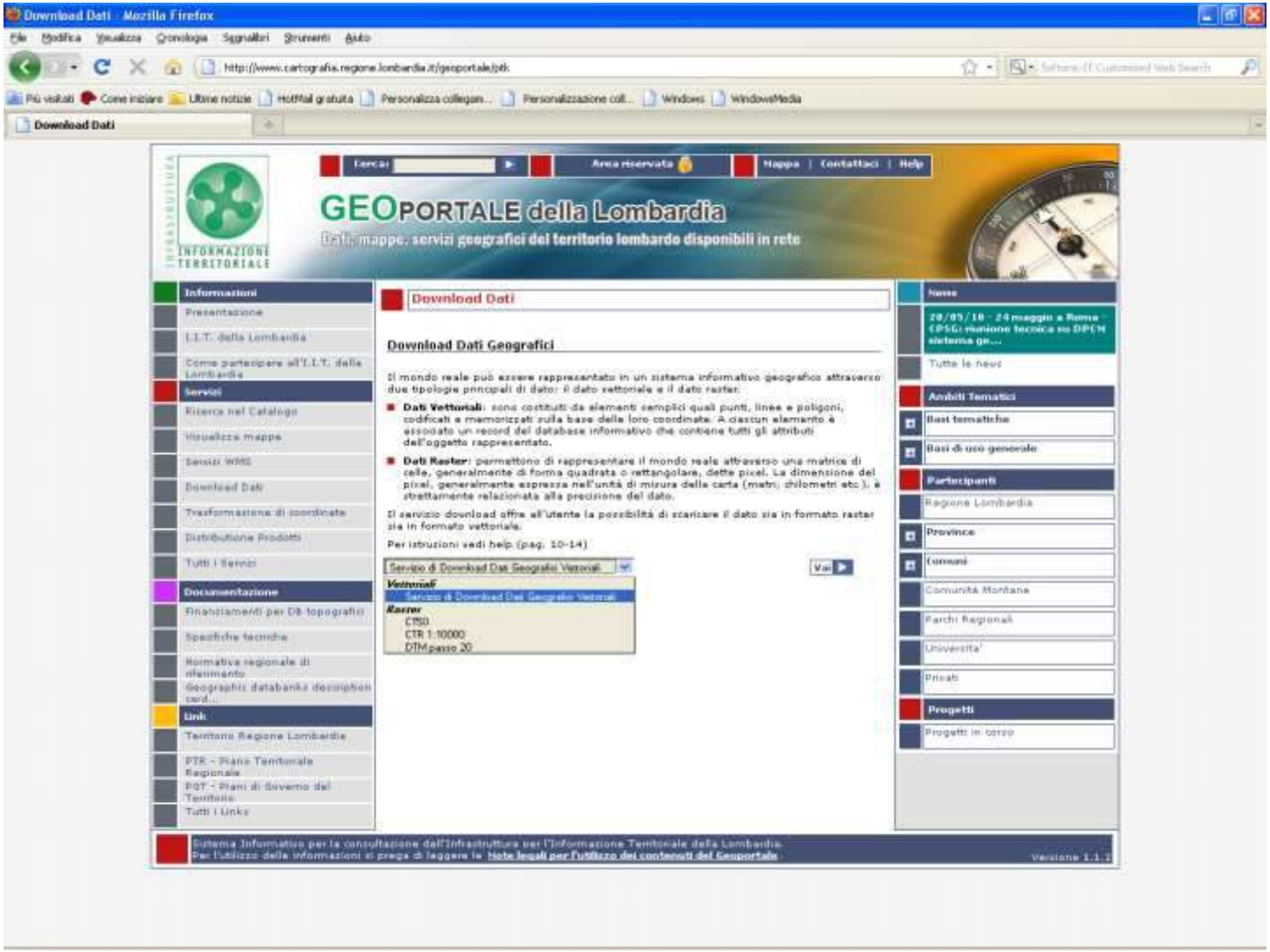
Il Portale Cartografico Nazionale
http://www.pcn.minambiente.it/GN/

ISTAT
http://www.istat.it/it/
Statistics and spatial dataset: urban blocks, municipalities,….

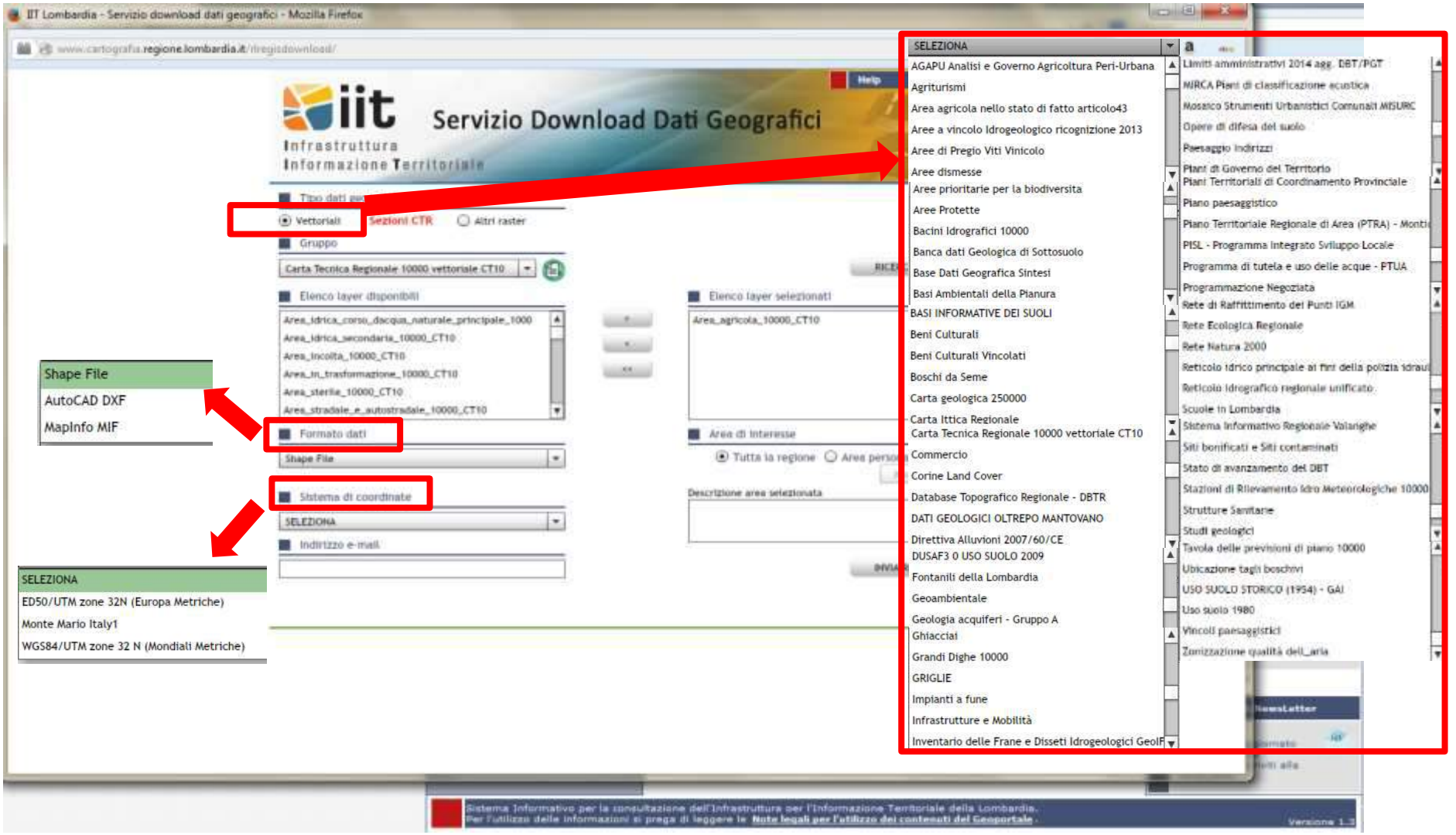
Regione Lombardia.
http://www.geoportale.regione.lombardia.it/
Download spatial data, web services

Open data
http://www.dati.gov.it/dataset

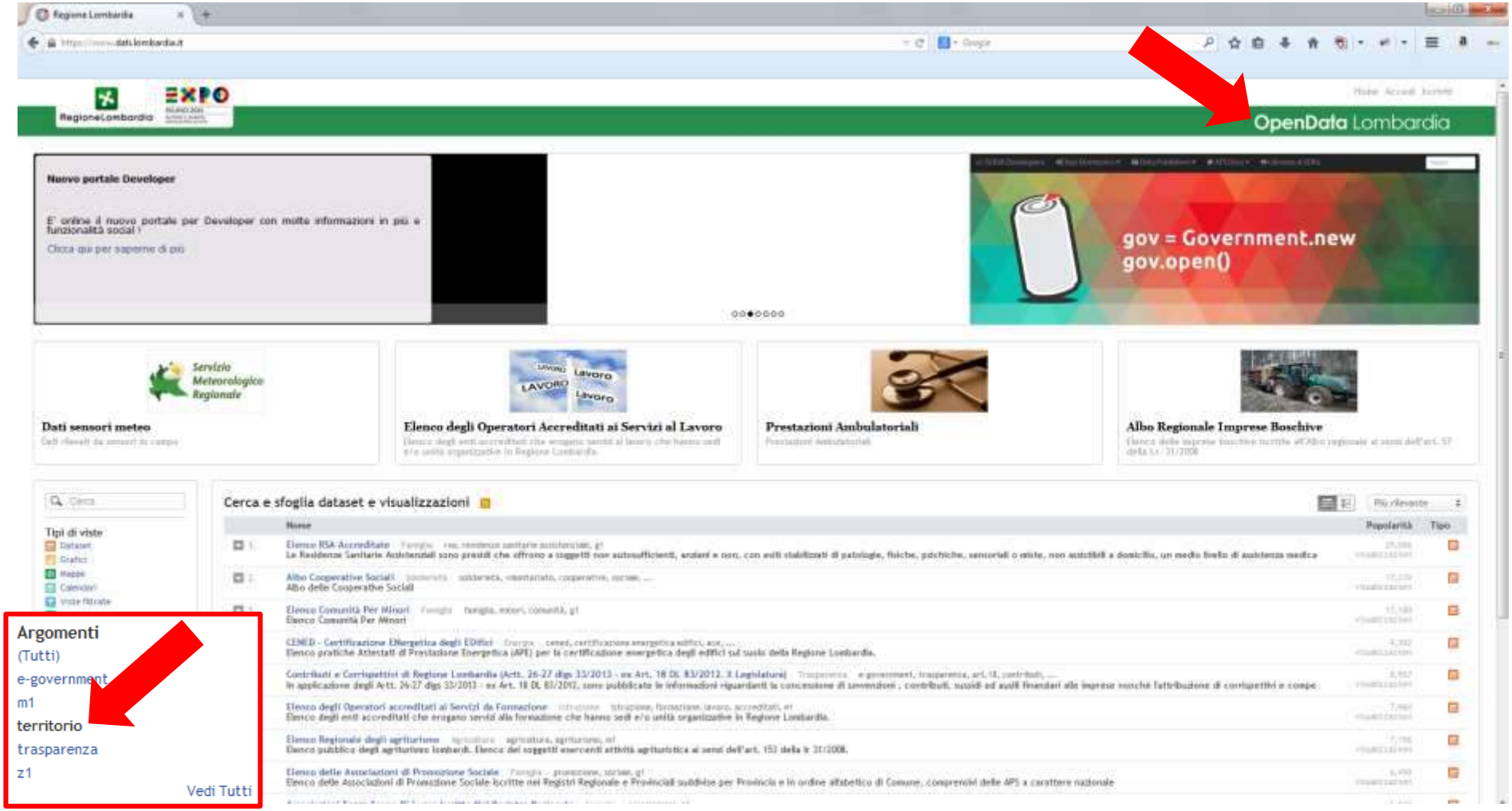
Lombardia Geoportal



Lombardia Geoportal: direct download

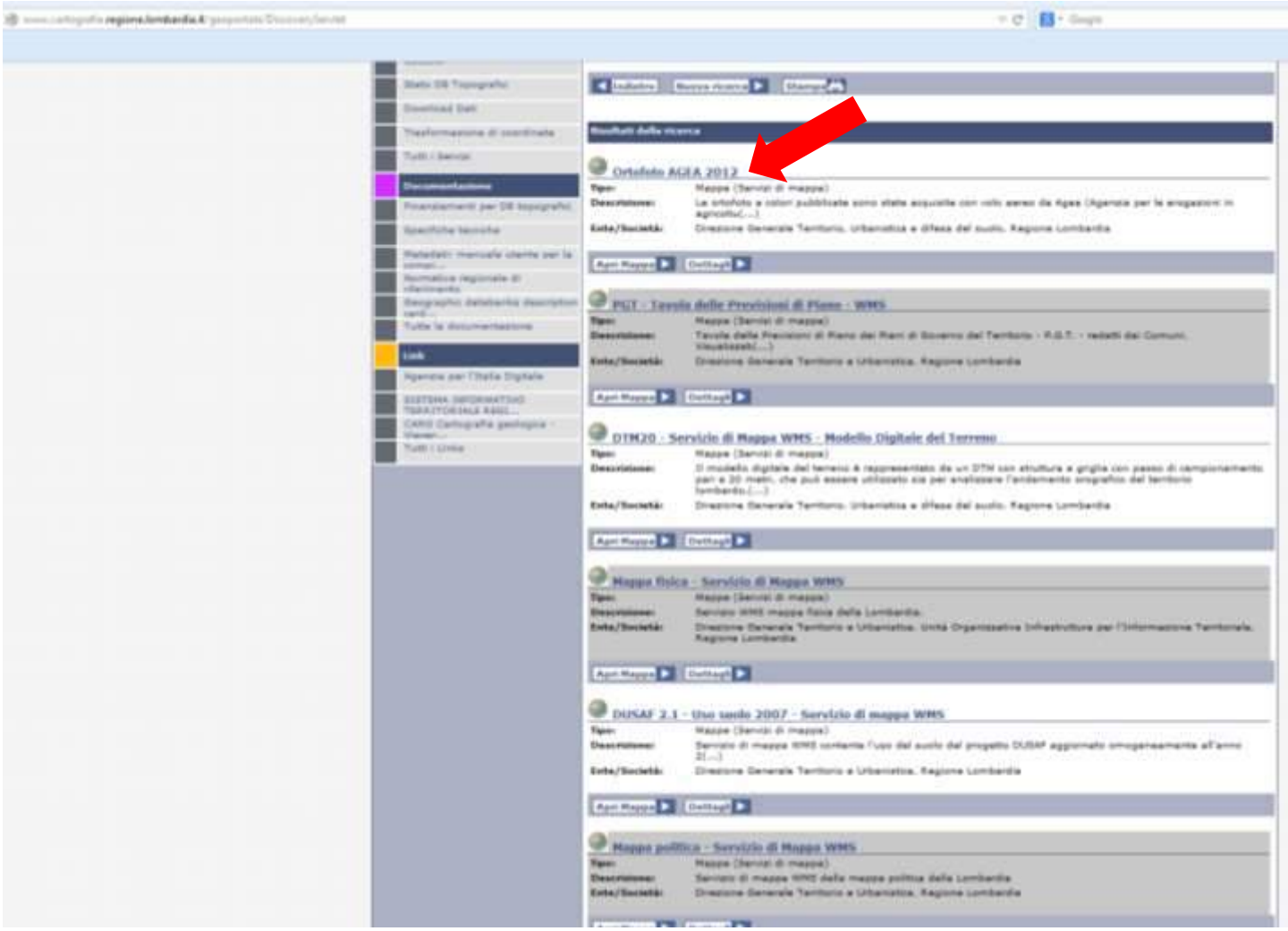


Open Data

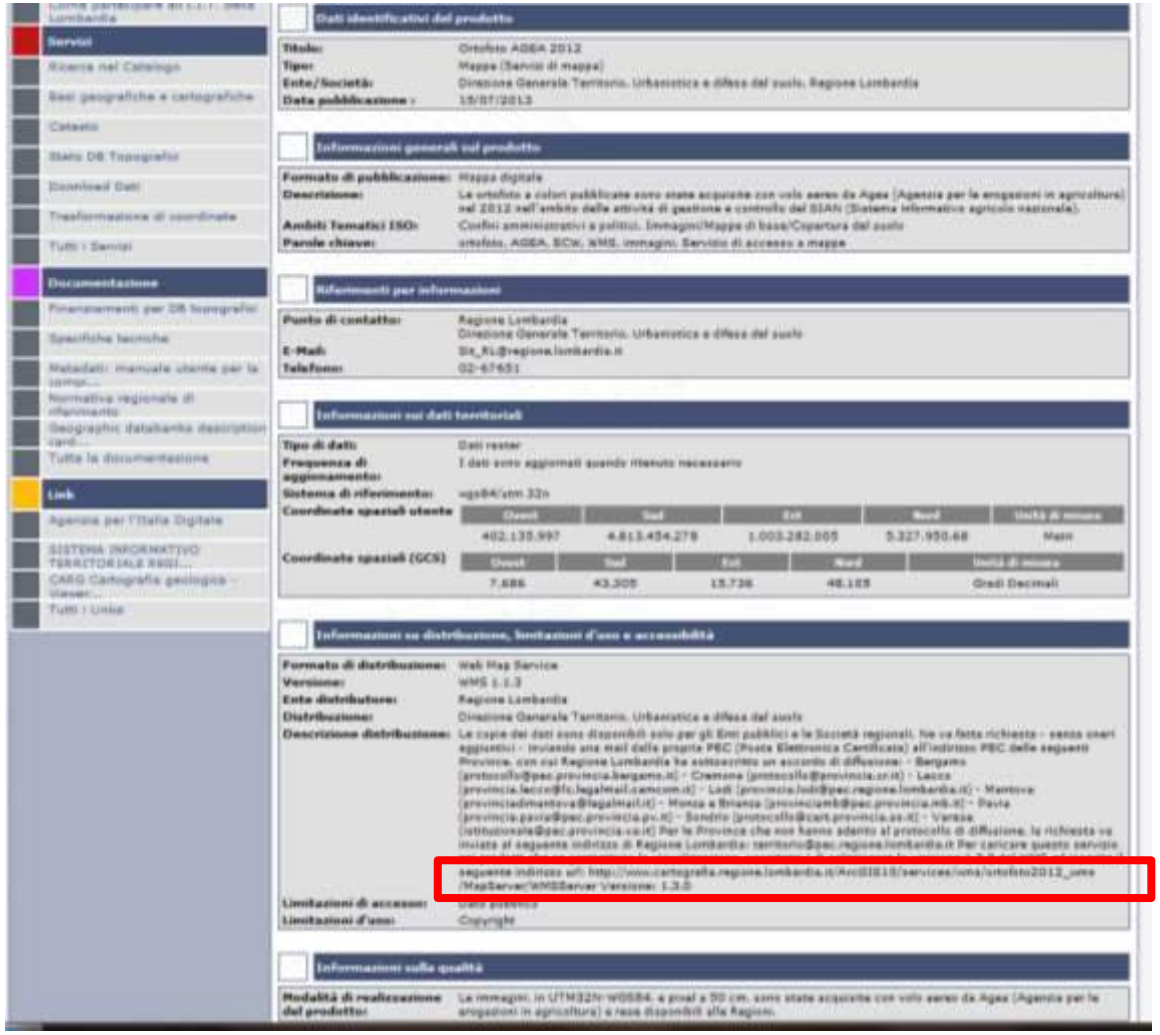

RegioneLombardia
EXPO
OpenData Lombardia
Nuovo portale Developer
E' online il nuovo portale per Developer con molte informazioni in più e funzionalità social !
Clicca qui per saperne di più
gov = Government.new
gov.open()
Servizio Meteorologico Regionale
Dati sensori meteo
Elenco degli Operatori Accreditati ai Servizi al Lavoro
Prestazioni Ambulatoriali
Albo Regionale Imprese Boschive
Cerca e sfoglia dataset e visualizzazioni
Tipi di viste
Argomenti
(Tutti)
e-government
m1
territorio
trasparenza
z1
Vedi Tutti

Lombardia Geoportal: wms

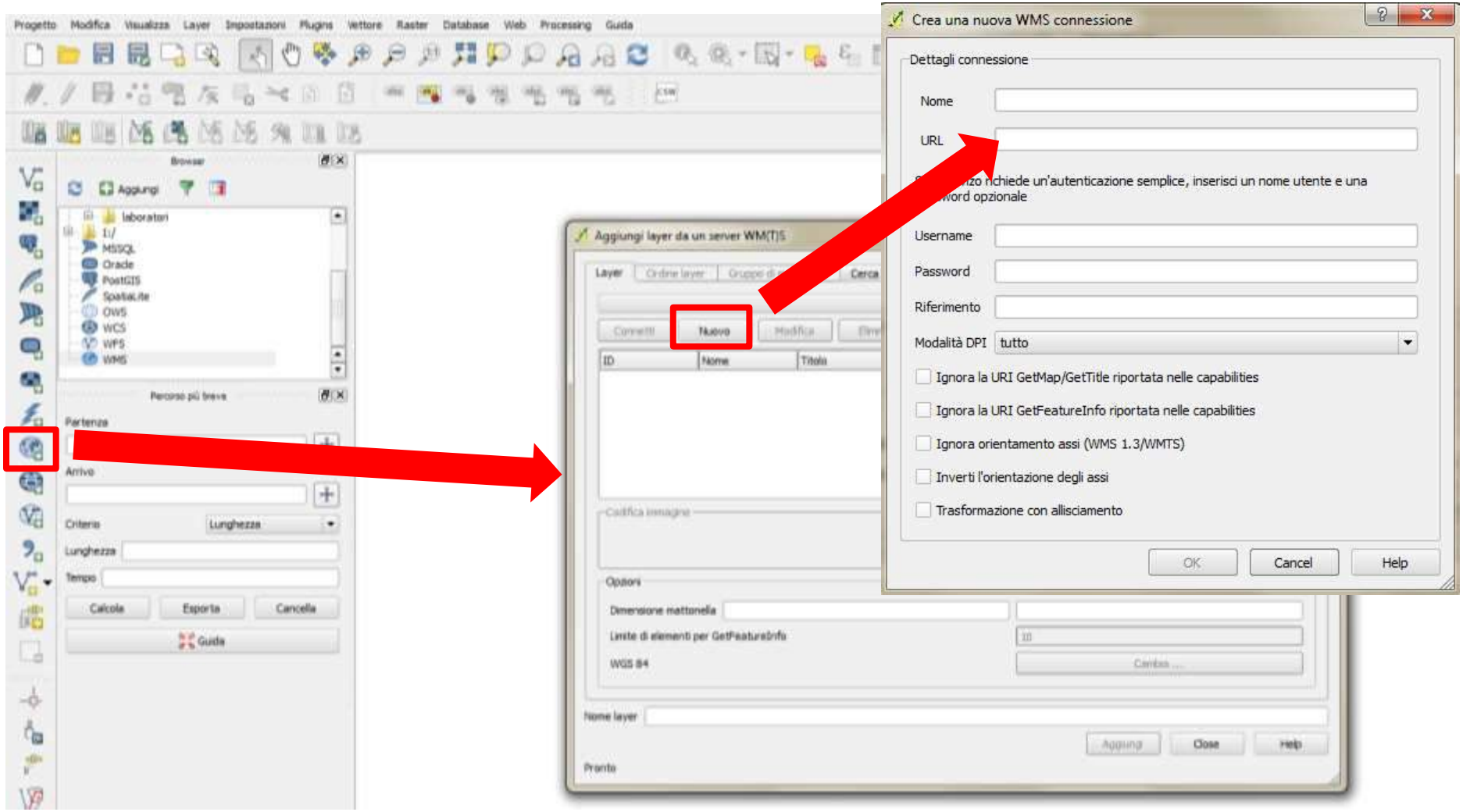
Lombardia Geoportal: wms



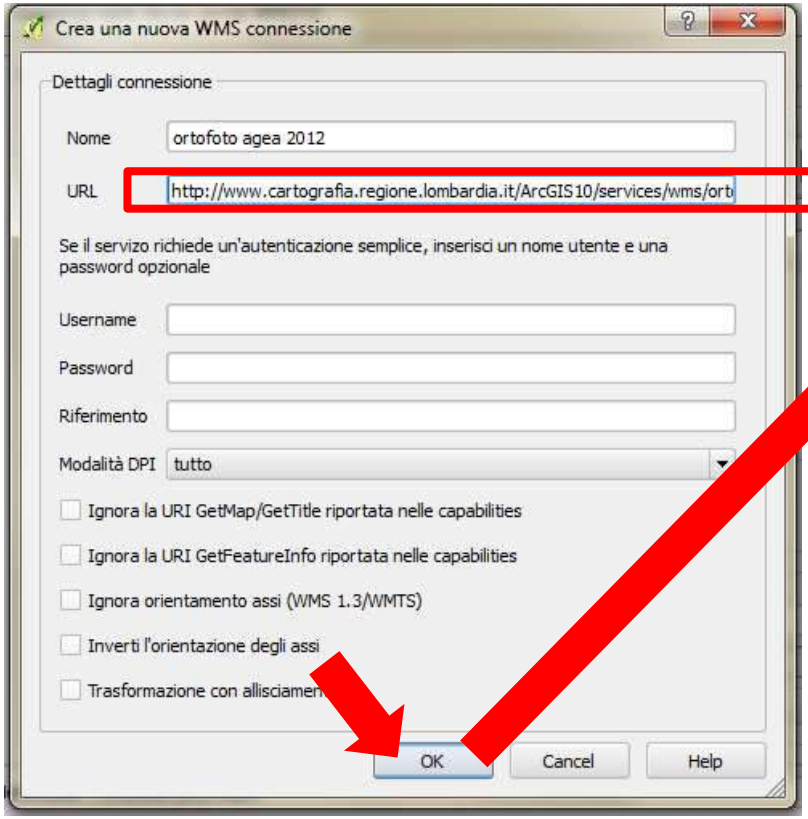
Lombardia Geoportal: wms services

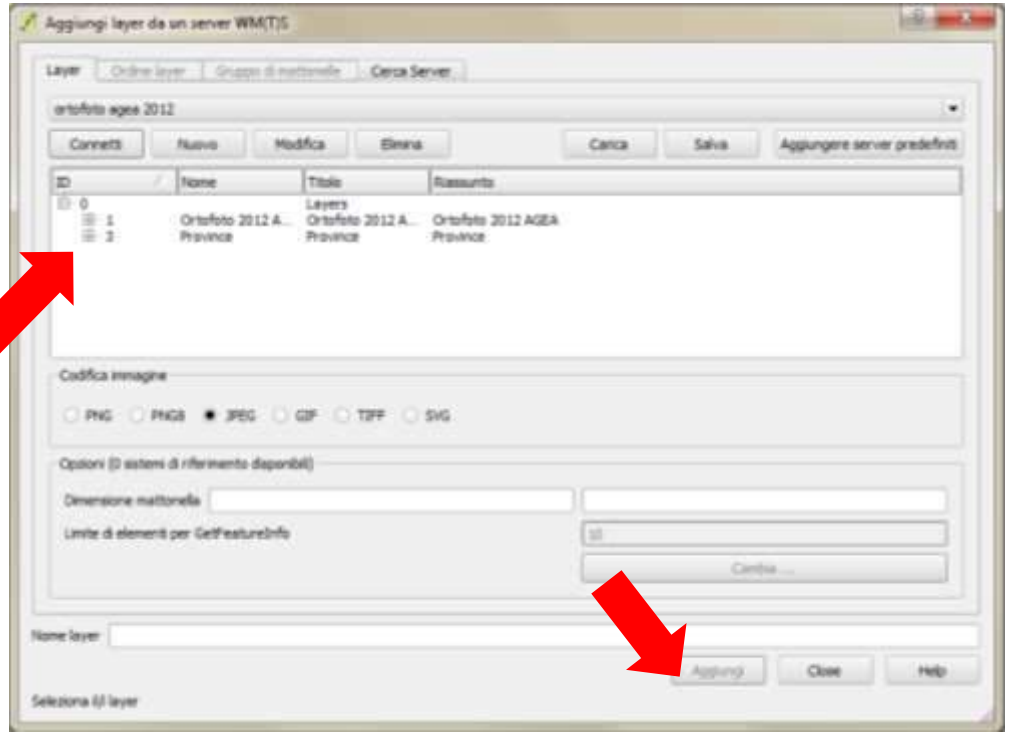


QGIS: WMS layer import

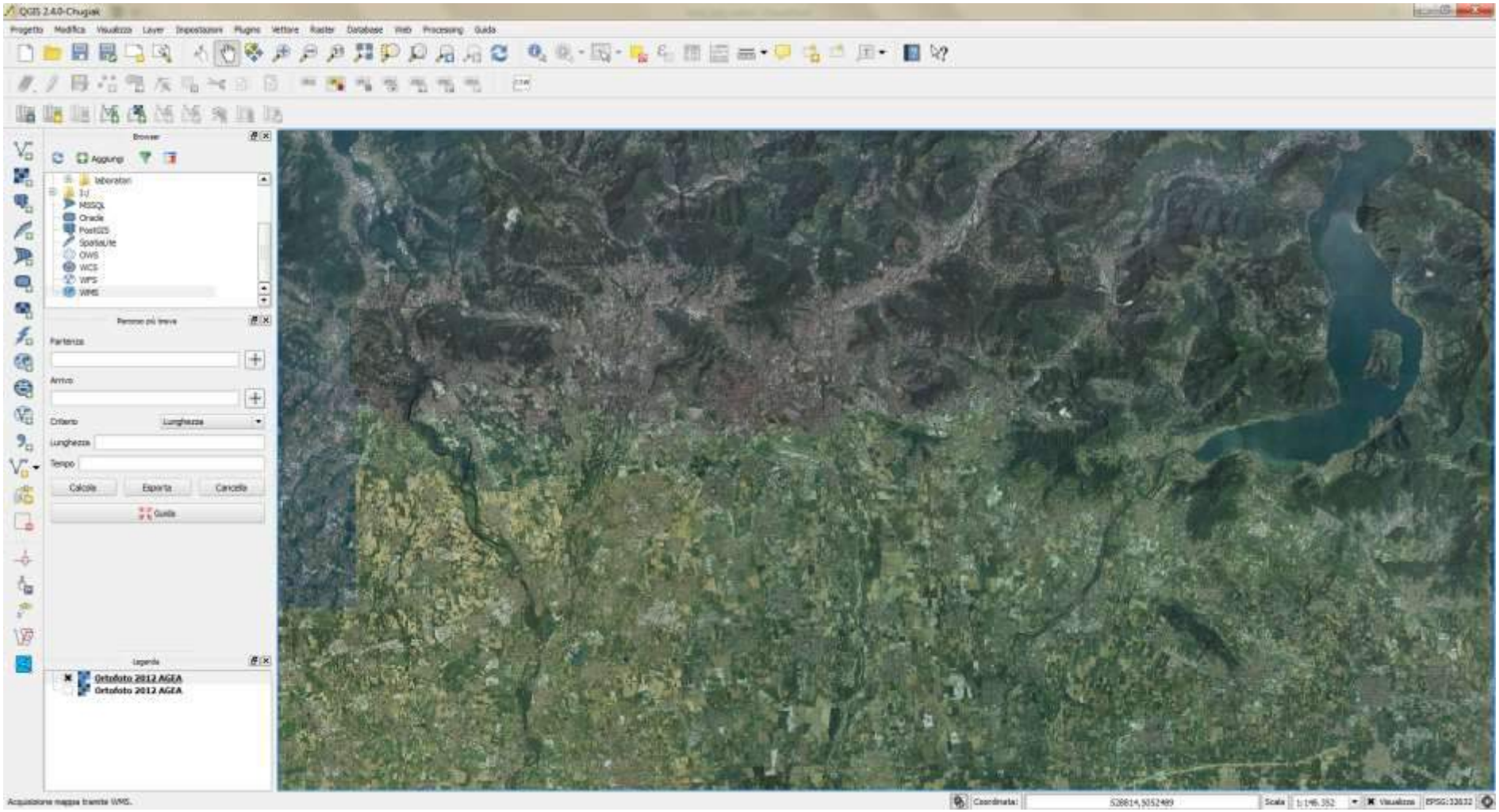


QGIS: WMS layer import





QGIS: WMS layer import



OpenStreetMap

OpenStreetMap is the largest open geographic database in the world, the data infrastructure for multitudes of mapping projects around the globe. Launched in 2004, OpenStreetMap works in an editable style similar to Wikipedia (3 million users)

Open Database Licence (ODbL)

OpenStreetMap is a community.

OpenStreetMap is open data: you are free to use it for any purpose as long as you credit OpenStreetMap and **its contributors**.

ODC Open Database License (ODbL) Summary

This is a human-readable summary of the ODbL 1.0 license. Please see the disclaimer below.

You are free:

To Share: To copy, distribute and use the database.

To Create: To produce works from the database.

To Adapt: To modify, transform and build upon the database.

As long as you:

Attribute: You must attribute any public use of the database, or works produced from the database, in the manner specified in the ODbL. For any use or redistribution of the database, or works produced from it, you must make clear to others the license of the database and keep intact any notices on the original database.

Share-Alike: If you publicly use any adapted version of this database, or works produced from an adapted database, you must also offer that adapted database under the ODbL.

Keep open: If you redistribute the database, or an adapted version of it, then you may use technological measures that restrict the work (such as DRM) as long as you also redistribute a version without such measures.

MORE INFORMATION

- Introduction to Open Data
- Open Definition for Data
- Quick guide to making data open
- Open Data Handbook

https://opendatacommons.org/licenses/odbl/summary/

OpenStreetMap's conceptual data model

Elements are the basic components of OpenStreetMap's *conceptual data model of the physical world*. They consist of

- **nodes** (defining points in space);
- **ways** (defining linear features and area boundaries);
- **relations** (which are used to explain how other elements work together).
- All of the above can have one or more associated tags (which describe the meaning of a particular element).

(a) Node
A drinking fountain as a single pair of coordinates.

```
lat: 40.7303993,
lon: -73.9970100,
version: 1,
tags: {
 amenity:
 drinking_water,
 name:
 Washington
Square}
```

(b) Way: Path
A series of 41 nodes which create this footway

```
id: 197582876,
changeset: 31859815,
uid: 1306,
version: 2,
timestamp: 2015-06-
10T03:06:09Z,
tags: {
 highway: footway}
```

(c) Way: Building
Series of 4 nodes that outline the arch

```
id: 248166269,
tags: {
 building: yes,
 height: 20.5,
 name:
Washington
Square Arch
 tourism:
attraction}
```

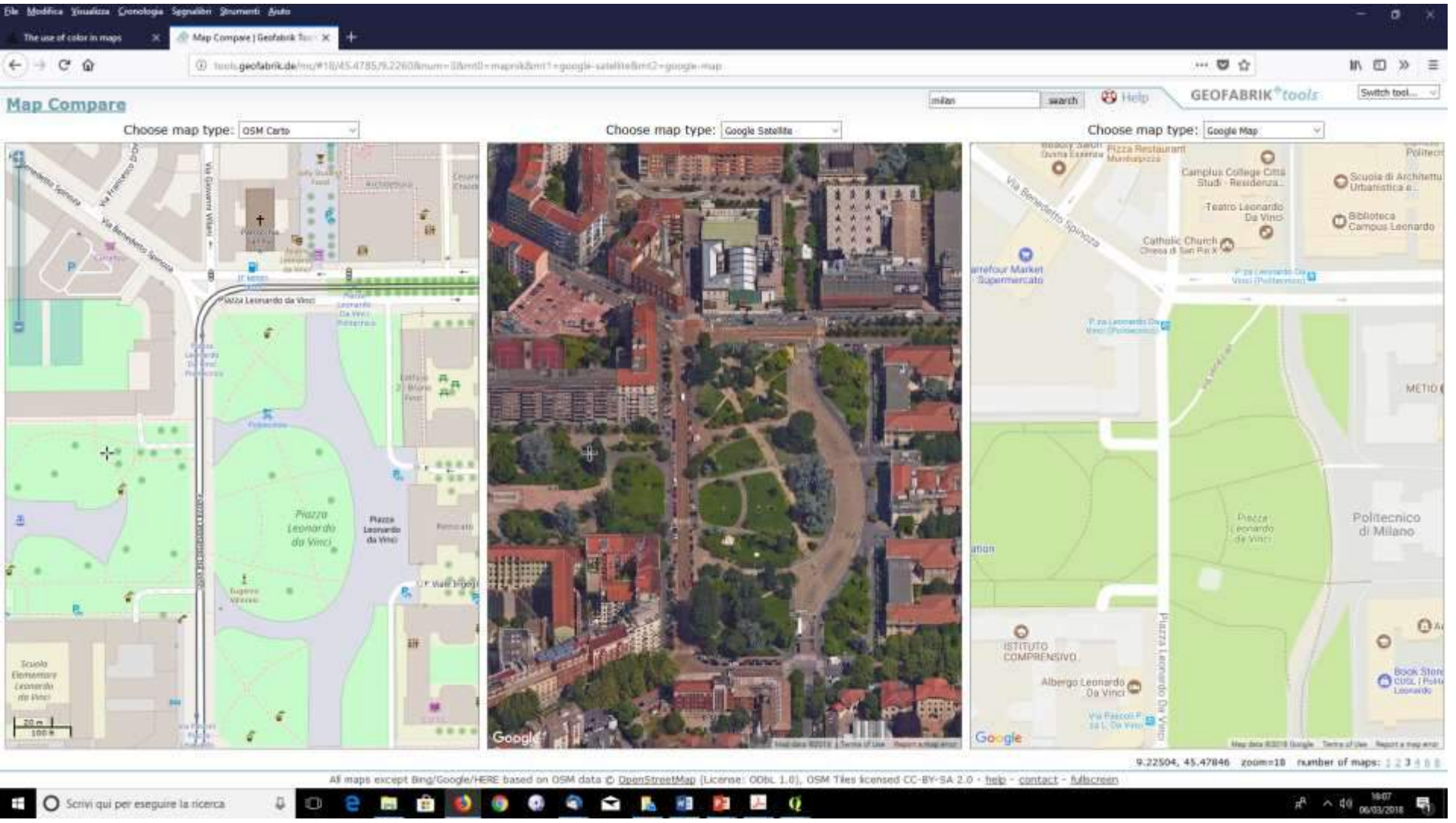
(d) Relation: Path
A collection of 3 ways creating a footway

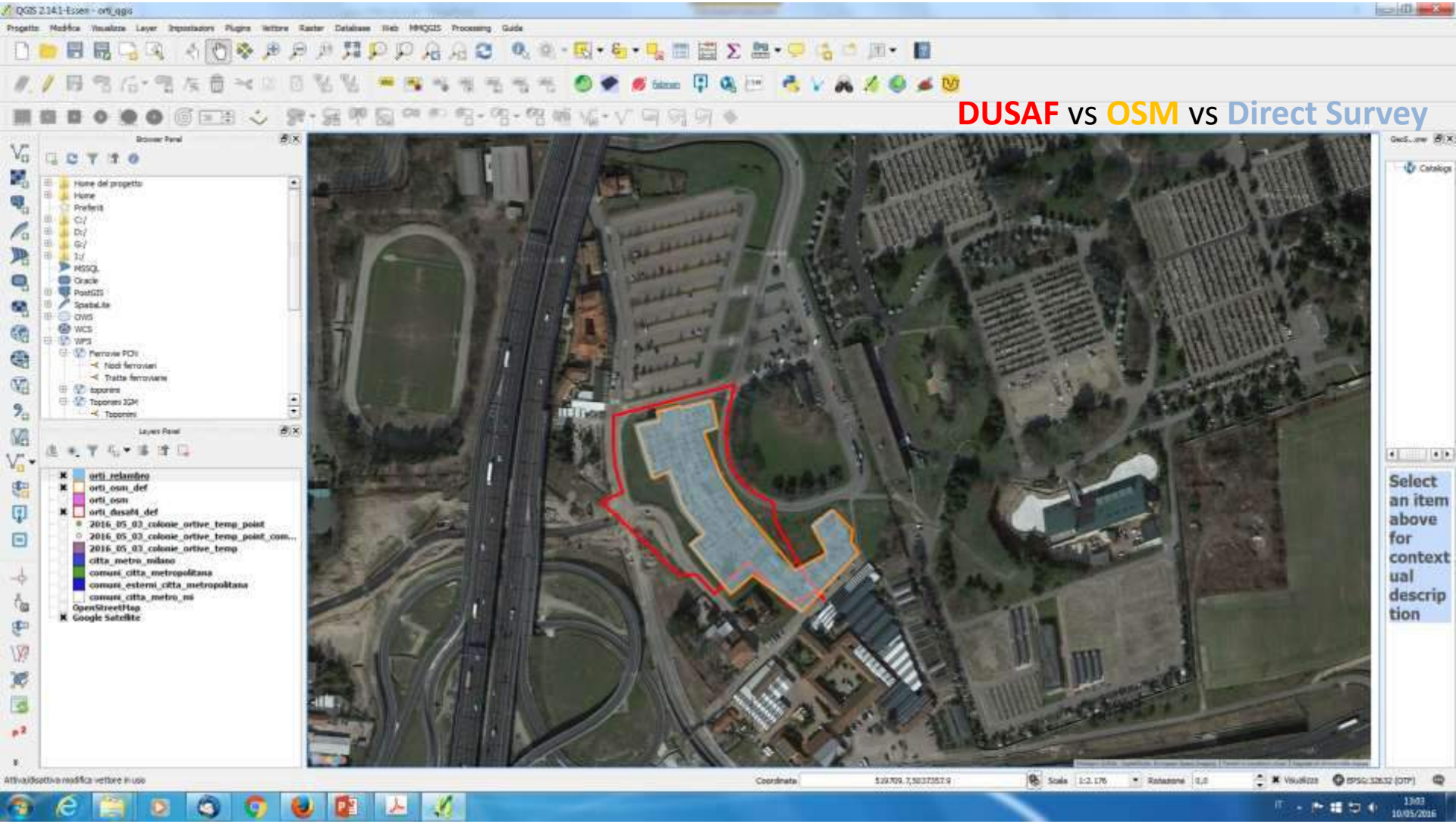
```
members: [
 {way: archId},
 {way: poolId},
 {way: parkId}
]
tags: {
 highway:
pedestrian}
```

OpenStreetMap for urban studies

- «Reliable» and «updated»
- Easy to add in GIS and in webapp
- Global coverage:
- Many uses:
  - background (openlayer, basemap)
  - Feature extraction (overpass turbo - http://overpass-turbo.eu/) or in Qgis
  - Available extracts for cities (Metro-extract https://mapzen.com/data/metro-extracts/), countries (http://download.geofabrik.de/), etc..
- Starting point for complex elaborations: accessibility, indicators, ….
- Complex articulation of features (*key, value*)
- Useful for classrooms
- Research results
- Potential for public administrations
- ……..

OSM / Google Maps comparison:
http://tools.geofabrik.de/mc/#18/45.4785/9.2260&num=3&mt0=mapnik&mt1=google-satellite&mt2=google-map




DUSAF vs OSM vs Direct Survey
orti_relambro
orti_osm_def
orti_osm
orti_dusaf4_def
2016_05_03_colonie_ortive_temp_point
2016_05_03_colonie_ortive_temp
citta_metro_milano
comuni_citta_metropolitana
comuni_esterni_citta_metropolitana
comuni_citta_metro_mi
OpenStreetMap
Google Satellite
Select an item above for contextual description

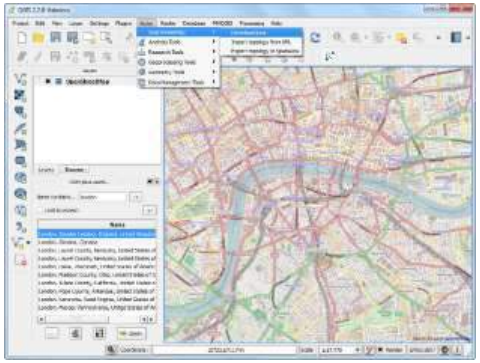
OpenStreetMap features

OpenStreetMap represents physical features on the ground (e.g., roads or buildings) using tags attached to its basic data structures (its nodes, ways, and relations). Each tag describes a geographic attribute of the feature being shown by that specific node, way or relation. OpenStreetMap's free tagging system allows the map to include an unlimited number of attributes describing each feature. The community agrees on certain key and value combinations for the most commonly used tags, which act as informal standards. However, users can create new tags to improve the style of the map or to support analyses that rely on previously unmapped attributes of the features. Short descriptions of tags that relate to particular topics or interests can be found using the feature pages.

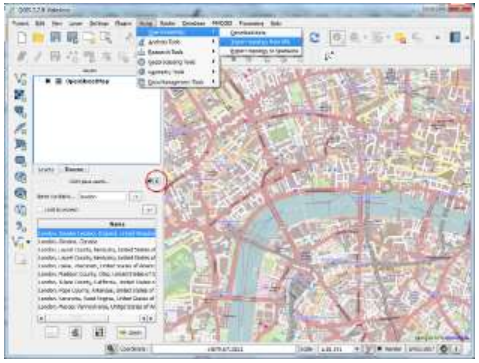
Getting high quality data is essential for any GIS task. One great resource for free and openly licensed data is OpenStreetMap(OSM) . The **OSM database** consits of streets, local data as well as building polygons. Getting access to OSM data in a GIS format is integrated in QGIS.

QGIS: import OSM data

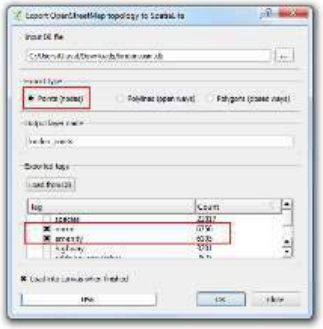
1. Download OSM data from map canvas



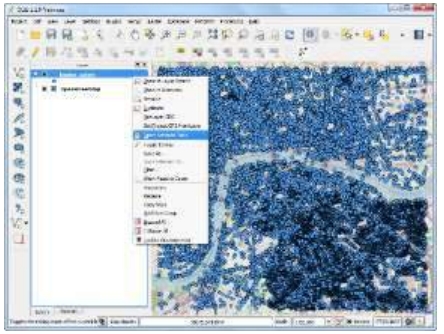
2. Import topology from XML file (**.osm*)



3. Export topology to spatialite (portable spatial db)



4. Load exported tags from db into map canvas



OSM: overpass-turbo

wiki.openstreetmap.org/wiki/Tag:highway%3Dmotorway

Più visitati | Come iniziare | Raccolta Web Slice | Siti suggeriti | Save to Mendeley

Pagina | Discussione | Leggi | Visualizza sorgente | Cronologia | Ricerca

Tag:highway=motorway

Available languages

• Deutsch • **English** • español • français • 日本語 • italiano • Nederlands • 日本語 • polski • português • português do Brasil • русский • українська

Other languages — Help us translating this wiki

The tag `highway=motorway` is used to identify the highest-performance roads within a territory. Typically, these controlled-access highways have a minimum of two lanes in each direction that are separated by a barrier. Motorways are commonly referred to as a **freeway** in American and Australian English. Non-motorised traffic is banned from using these roads in most territories, with some exceptions, for example rural motorways in western U.S.

For roads that do not meet the above requirements consider using `highway=trunk`. See Highway:International equivalence for guidance on the use of motorway in different countries.

Use `highway=motorway_link` for shorter link roads (sliproads/ramps) leading to and from a motorway.

Indice [nascondi]

1 Implied values
2 How to map
3 International equivalence
4 Quality tool

Implied values

While the box on the right lists some implied tags, they have been changed several times, they are often country-specific and the community does not agree about the implications. Please tag them anyways to clear out any doubt.

How to map

highway=motorway, lanes=4, oneway=yes, int_ref=E 451, ref=A 5, destination.Darmstadt

A motorway is normally represented by a series two parallel ways, one for each carriageway tagged with `highway=motorway`. These ways should all point direction of travel and be tagged with `oneway=yes`. In the less usual case of a motorway where traffic travels in both directions along the same carriageway use a single way and tag it with `oneway=no`. When drawing parallel ways, place the nodes for each direction next to each other, which results in a better representation on most maps. The following tags may be applicable:

Tagging scheme for `highway=motorway`

Tag	Description	Example
`name=*`	Name of the motorway.	Autostrada dei Fiori
`ref=*`	Reference name.	A3
`oneway=yes`	See section #How to map	
`lanes=*`	Number of lanes.	3
`maxspeed=*`	The maximum speed which is allowed (in km/h).	130
`minspeed=*`	Minimum speed which a vehicle must be capable of to use the motorway (in km/h).	50
`destination=*`	Name of town for the direction of the motorway. Normally the town written on the sign wich belongs to the motorway-link.	Frankfurt
`carriageway_ref=*`	In the UK, the reference number for the carriageway, as displayed on Highway Agency signing	B

Consider adding the all of these ways to a relation of type (what type of relation? Peterlo 02:47, 20 January 2013 (UTC))

highway = motorway

Description

High capacity highways designed to safely carry fast motor traffic.

Group: Highway

Used on these elements

Useful combination

- `name=*`
- `ref=*`
- `oneway=yes`
- `lanes=*`
- `destination=*`

Implies

- `access=no`
- `motor_vehicle=yes`
- `oneway=yes`
- `surface=paved`

Status: Approved

taginfo [More...]

	8	0.00 %
	597 767	0.72 %
	85	0.56 %

Tools for this tag

- taginfo, fr, it, ie, us
- overpass-turbo

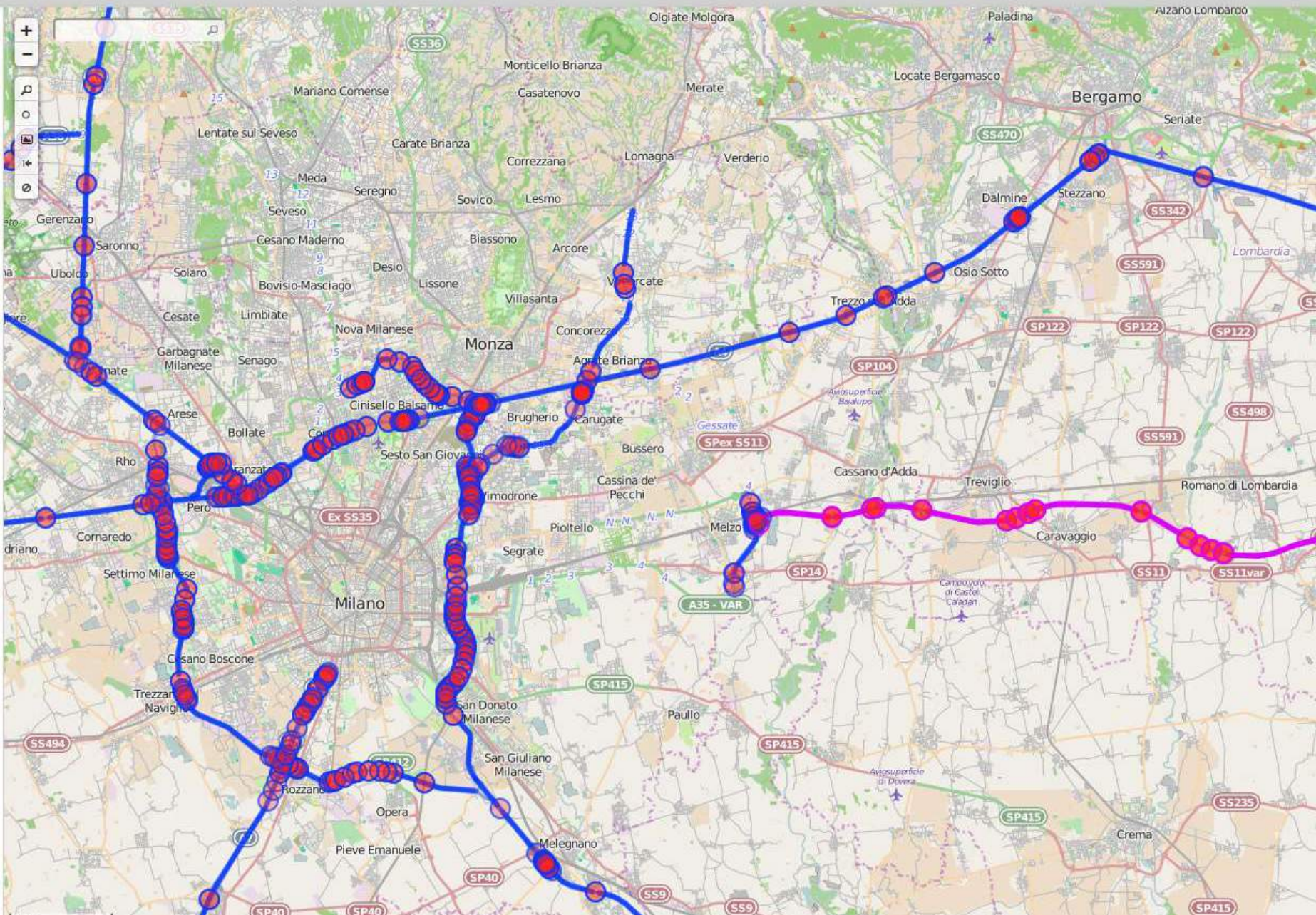
Pagina principale
The map
Map Features
Contributors
Aiuto
Blogs
Shop
Donations
Ultime modifiche
Strumenti
Puntano qui
Modifiche correlate
Pagine speciali
Versione stampabile
Link permanente
Informazioni sulla pagina
Cita questa pagina

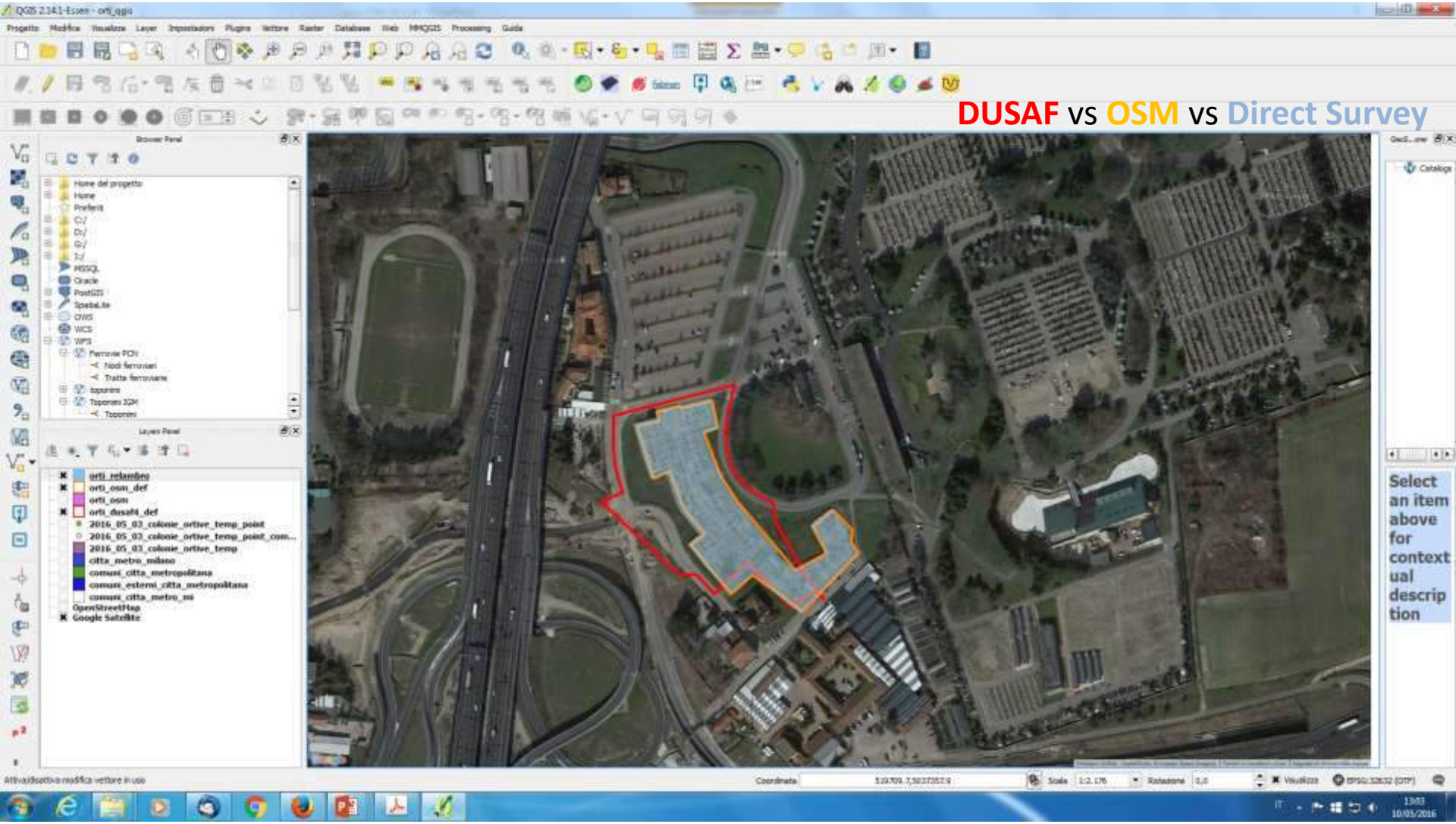
Google Trends - Web Search interest: openstreetmap - Worldwide, 2004 - present

wiki openstreetmap

Siti suggeriti | Save to Mendeley

Salva | Carica | Impostazioni | Aiuto | overpass turbo




DUSAF vs OSM vs Direct Survey
orti_relambro
orti_osm_def
orti_osm
orti_dusaf4_def
2016_05_03_colonie_ortive_temp_point
2016_05_03_colonie_ortive_temp
citta_metro_milano
comuni_citta_metropolitana
comuni_esterni_citta_metropolitana
comuni_citta_metro_mi
OpenStreetMap
Google Satellite
Select an item above for contextual description

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Longley, P. A., Goodchild, M. F., Maguire, D. J., and Rhind, D. W. 2001. *Geographic information system and Science*. Oxford: John Wiley & Sons, Ltd.

Pucci, P., Manfredini, F., & Tagliolato, P. (2015). *Mapping urban practices through mobile phone data*. Heidelberg, New York, Dordrecht, London: Springer.

http://www.for-rent.polimi.it/mappature/

http://giscommons.org/introduction-concepts/

http://www.qgis.org/it/site/

http://www.qgistutorials.com/en/

http://colorbrewer2.org/#type=sequential&scheme=BuGn&n=3

http://metrocosm.com/mercator/

https://www.openstreetmap.org/#map=5/51.500/-0.100