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Regional training workshop on geographical information system for energy planning

UNIVERSITÉ DE GENÈVE

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Data and metadata collection guidelines

Introduction to geographic data

Dakar, 12 August 2014

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Université de Genève
UNEP/GRID-Geneva

Introduction to geospatial data

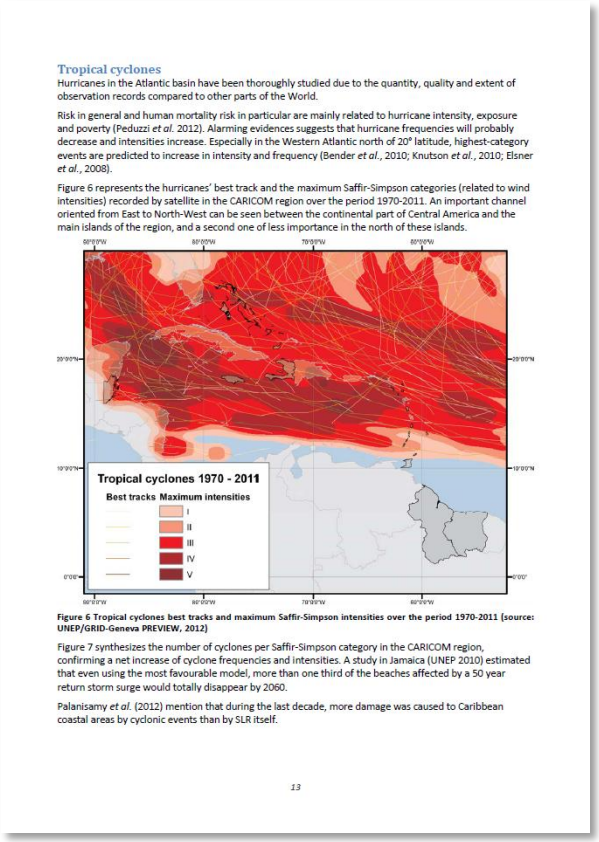
What do we mean by geographic data?

… any data with a <u>geographical</u> component ,

<u>formated</u> to be used in a Geographical Information System

and provided with proper <u>metadata</u>.

***Synonyms*: Geodata, spatial data,…**



Tropical cyclones

Hurricanes in the Atlantic basin have been thoroughly studied due to the quantity, quality and extent of observation records compared to other parts of the World.

Risk in general and human mortality risk in particular are mainly related to hurricane intensity, exposure and poverty (Peduzzi *et al.* 2012). Alarming evidences suggests that hurricane frequencies will probably decrease and intensities increase. Especially in the Western Atlantic north of 20° latitude, highest-category events are predicted to increase in intensity and frequency (Bender *et al.*, 2010; Knutson *et al.*, 2010; Elsner *et al.*, 2008).

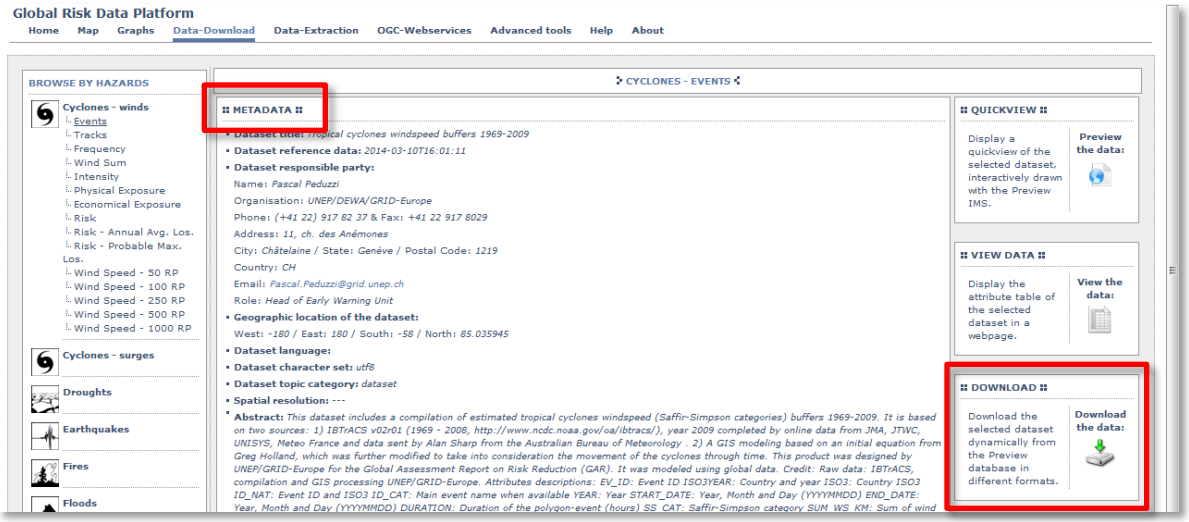
Figure 6 represents the hurricanes' best track and the maximum Saffir-Simpson categories (related to wind intensities) recorded by satellite in the CARICOM region over the period 1970-2011. An important channel oriented from East to North-West can be seen between the continental part of Central America and the main islands of the region, and a second one of less importance in the north of these islands.

Figure 6 Tropical cyclones best tracks and maximum Saffir-Simpson intensities over the period 1970-2011 (source: UNEP/GRID-Geneva PREVIEW, 2012)

Figure 7 synthesizes the number of cyclones per Saffir-Simpson category in the CARICOM region, confirming a net increase of cyclone frequencies and intensities. A study in Jamaica (UNEP 2010) estimated that even using the most favourable model, more than one third of the beaches affected by a 50 year return storm surge would totally disappear by 2060.

Palanisamy *et al.* (2012) mention that during the last decade, more damage was caused to Caribbean coastal areas by cyclonic events than by SLR itself.

A report, table or a figure is not a geographic data, but a proper reference (in this case "source: UNEP/GRID-Geneva PREVIEW, 2012") can lead to geographic data



In other words

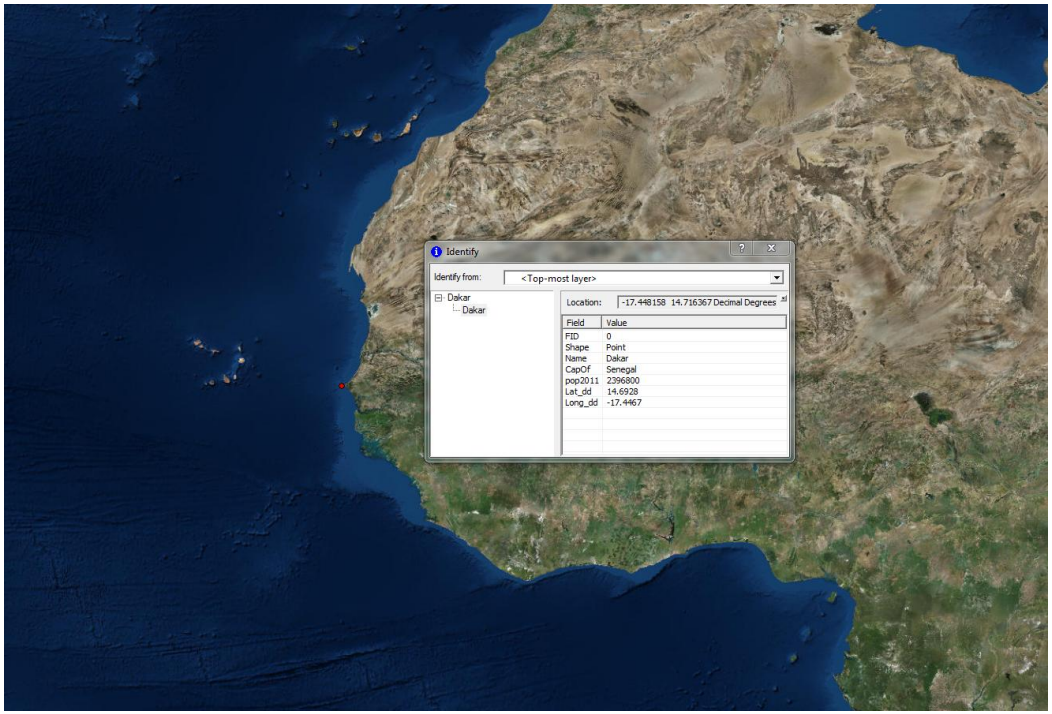
Dakar is the capital and largest city of Senegal… population (2011) 2,396,800, coordinates 14° 41′34″N 17° 26′48″W

NO

F11

	A	B	C	D	E
1	Name	Capital of	Population 2011	Latitude	Longitude
2	Dakar	Senegal	2'396'800	14° 41' 34" N	17° 26' 48" W

NO



… open source as well

Dakar is the capital and largest city of Senegal… population (2011) 2,396,800, coordinates 14° 41′34″N 17° 26′48″W

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F11

	A	B	C	D	E
1	Name	Capital of	Population 2011	Latitude	Longitude
2	Dakar	Senegal	2'396'800	14° 41' 34" N	17° 26' 48" W

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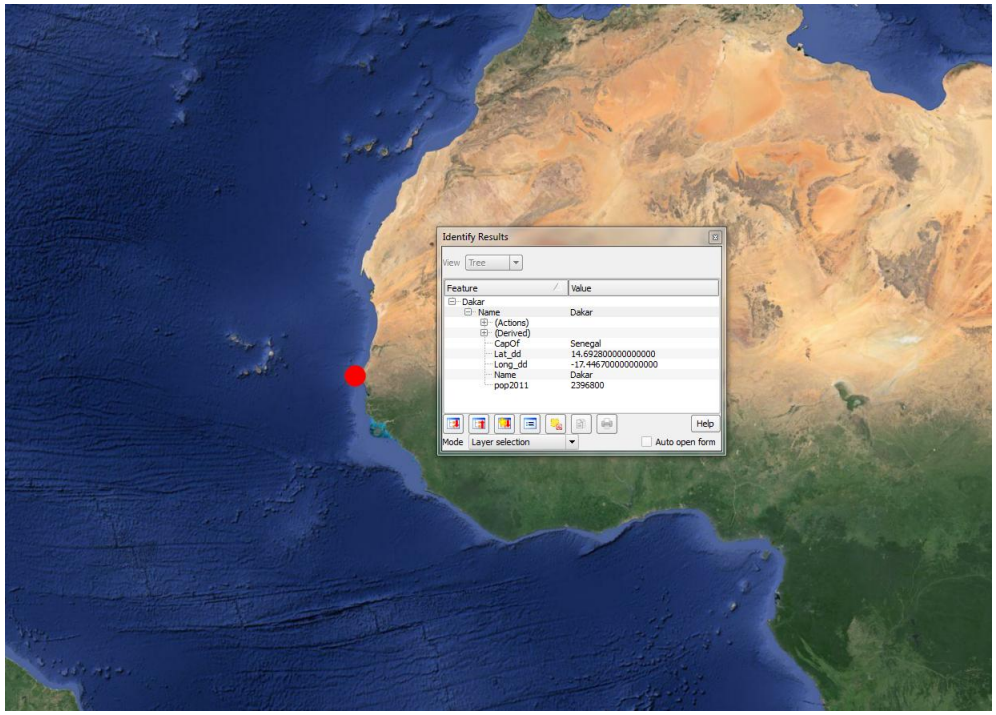
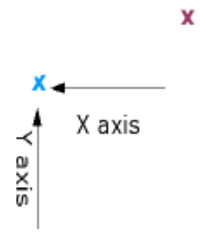
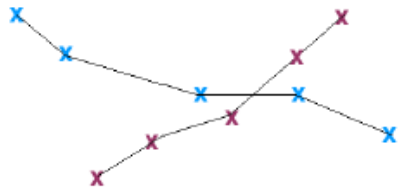
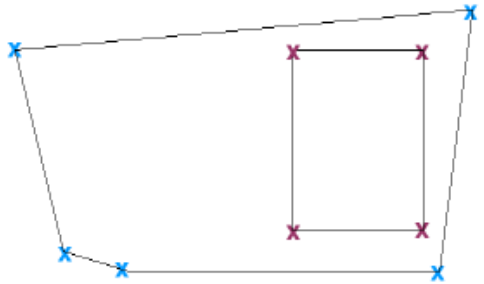


Name
CapOf
Pop2011
Lat_dd
Long_dd

- **short attribute name**
- **description on metadata compulsory**

Different format: Vector

Vectors are composed of features (anything you can see on the landscape, e.g. houses, roads, lakes) containing attributes (text or numerical information describing the feature).

Vector Point Feature	Vector Polyline Feature	Vector Polygon Feature
Point Geometry (indicates the x,y)	**Polyline Geometry (a series of connected vertices that do not form an enclosed shape)**	**Polygon Geometry (a series of connected vertices that do form an enclosed shape)**
		
Point attributes (describe the feature)	**Polyline attributes (describe the feature)**	**Polygon attributes (describe the feature)**
Id, Name, Description	*Id, Name, Description*	*Id, Name, Description*
1, Tree, Outside our classroom 2, Light post, At the school entrance	1, Footpath 1, From class to the playground 2, Footpath 2, From the school gate to the hall	1, School Boundary, Fenceline for the school 2, Sports Field, We play soccer here

Source: http://linfiniti.com/dla/ *vector data worksheet*

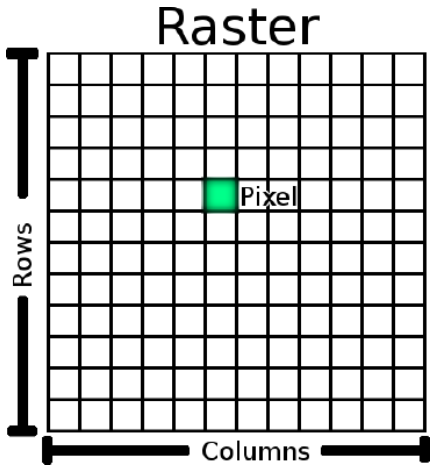
Different format: Raster

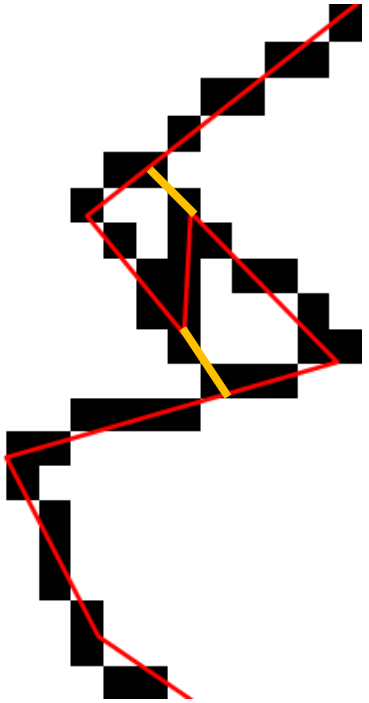
Rasters are made up of a matrix (composed of rows and columns) of pixels (also called cells), each one representing the condition of corresponding geographical region.

Raster data is used in a GIS application when we want to display information that is continuous across an area and cannot easily be divided into vector features (as for example elevation or solar exposition.

Vector can be rasterized, but only numerical attribute, one by one and it will create uncertainty.

Vectorization is also possible but remains uncertain.



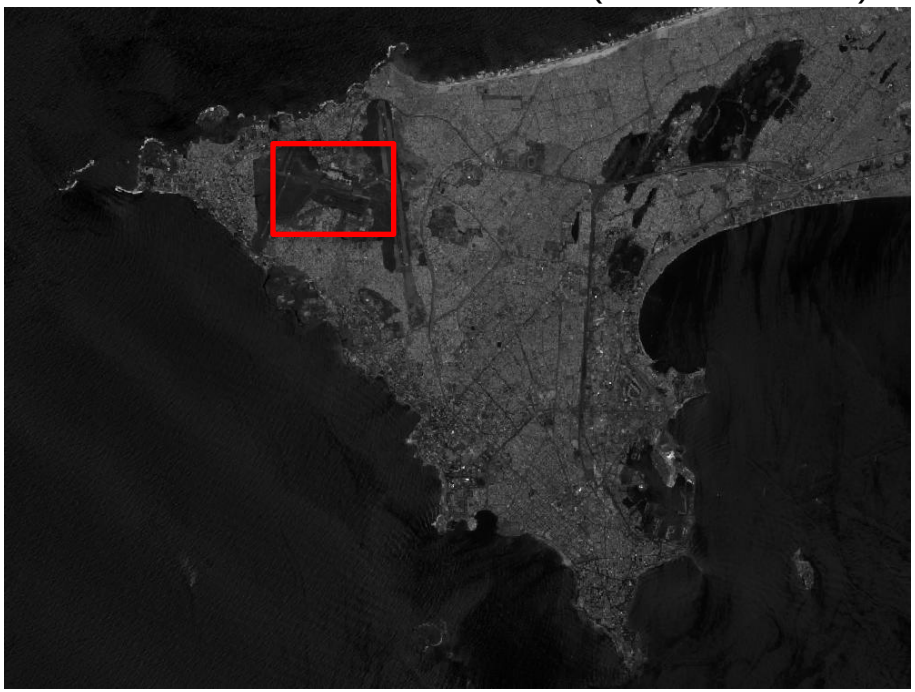


Source: http://linfiniti.com/dla/ *raster data worksheet*

Different format: Raster

Raster resolution will constrain the scale of work

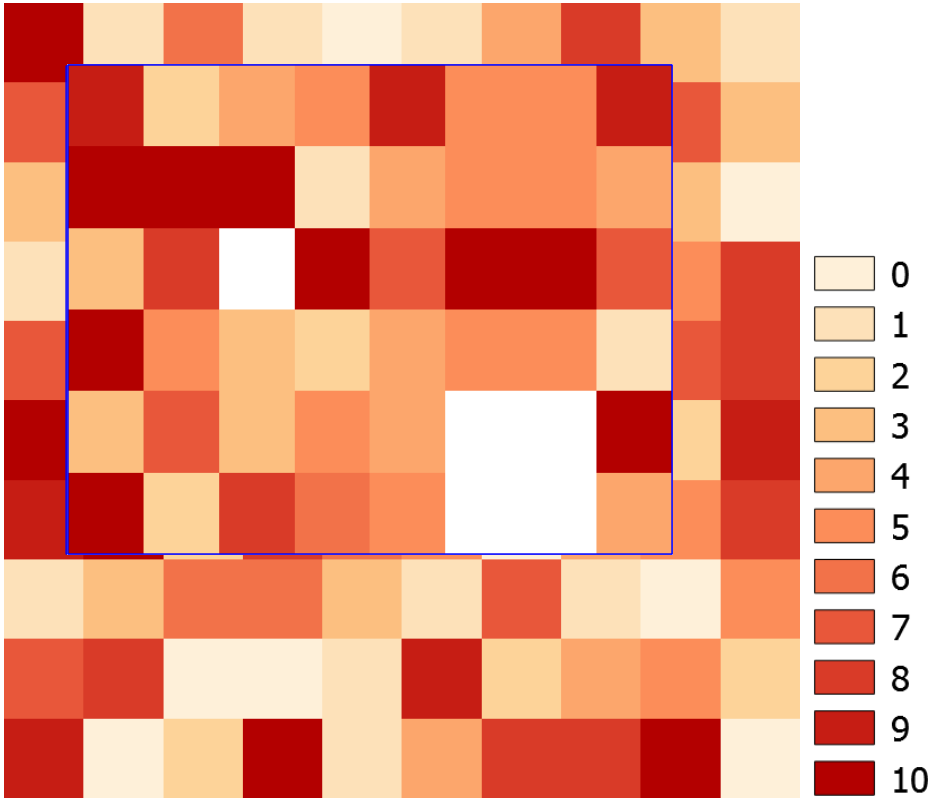
Landsat 8 18.4.2014 Panchromatic (15 m resolution)



Different format: Raster

Raster geographical accuracy is defined by its resolution (pixel size).

On the contrary of vectors, pixels values and extent is easily modified when processing them and should be manipulated with care and know-how !

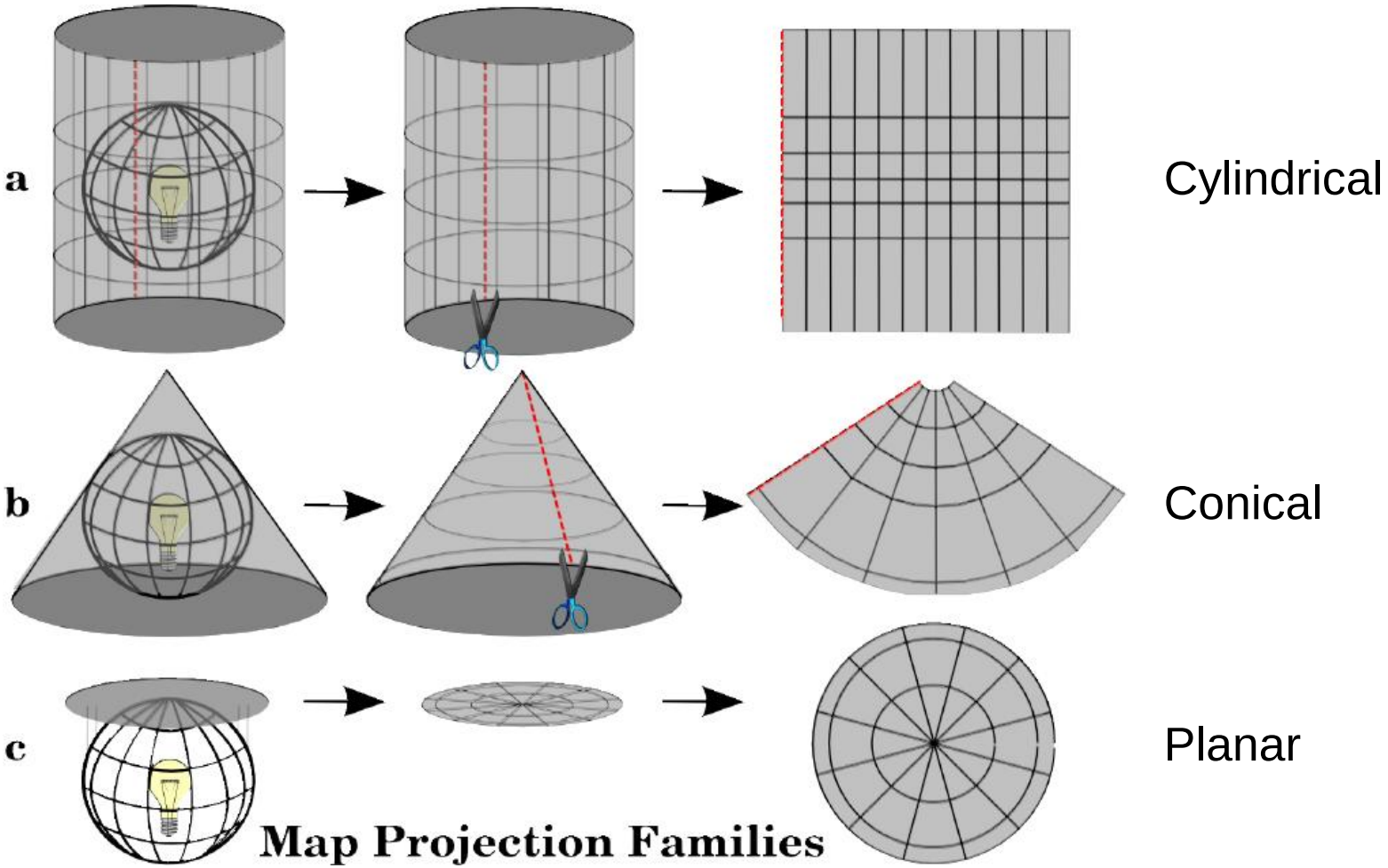


Pixel size: 1.00, 1.00
Pixel size: 0.95, 1.02

- **pixels size modified**
- **pixels values modified**
- **shifted pixels**
- **0 became nodata**

Coordinate Reference Systems (CRS)

A CRS defines how the <u>two dimensional</u>, projected map in your GIS is related to real places on the earth (<u>globe</u>).



Cylindrical

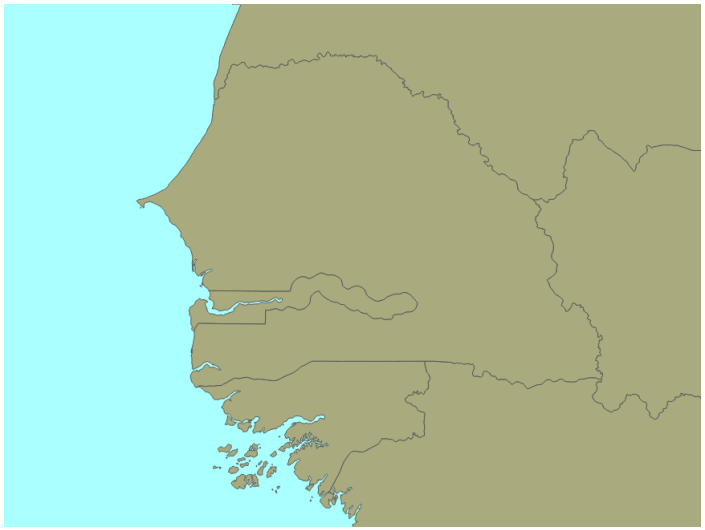
Conical

Planar

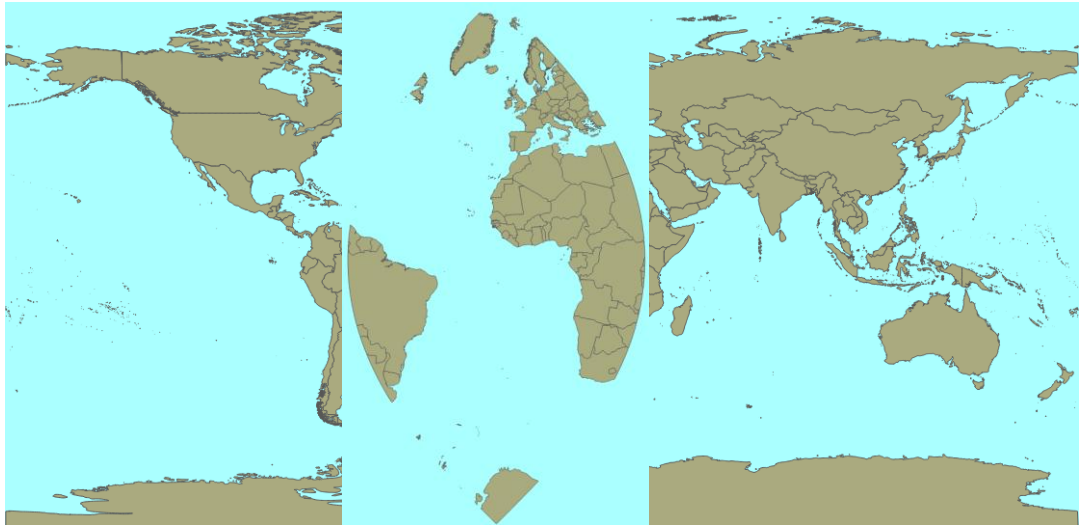
Source: http://linfiniti.com/dla/ *coordinate reference systems worksheet*

Coordinate Reference Systems (CRS)

The decision as to which map projection and coordinate reference system to use, depends on the regional extent of the area you want to work in, on the analysis you want to do.



WGS84 (EPSG:4326)



UTM zone 28 N (EPSG:32628)

Source: http://linfiniti.com/dla/ *coordinate reference systems worksheet*

Find or define proper CRS

Define proper CRS

http://epsg.io

epsg.io Coordinate Systems Worldwide

Coordinate reference systems for "senegal"

Found 6 valid records and 4 deprecated records (in 0.0699999999997 seconds)

senegal

SEARCH

Yoff / UTM zone 28N
EPSG:31028
Area of use: Senegal - onshore and offshore.
Coordinates on a map

Yoff
EPSG:4310
Area of use: Senegal - onshore and offshore.
Coordinates on a map

Point 58
EPSG:4620 with transformation: 1880
Area of use: Burkina Faso - central; Niger - southwest, in proximity to the parallel of latitude of 12°N. (accuracy: 44.0)
Coordinates on a map

WGS 84 / UTM zone 28N
EPSG:32628
Area of use: Between 18°W and 12°W, northern hemisphere between equator and 84°N, onshore and offshore. Gambia. Greenland. Guinea. Guinea
Coordinates on a map

Type of results

Coordinate reference systems (10)
Projected (2)
Geodetic (4)
Geodetic 3D (2)
Geocentric (2)

Operation (4)
Transformation (2)
Compound (1)
Conversion (1)

Datum (2)
Geodetic (2)

Area (6)

Filter utm zone 28n

Recently used coordinate reference systems

Coordinate Reference System	Authority ID
WGS 84 / UTM zone 28N	EPSG:32628

EPSG:32628

Projected coordinate system

WGS 84 / UTM zone 28N

Attributes

Unit: metre

Geodetic CRS: WGS 84

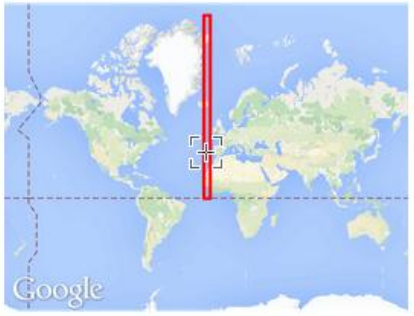
Datum: World Geodetic System 1984

Ellipsoid: WGS 84

Prime meridian: Greenwich

Data source: OGP

Revision date: 1995-06-02



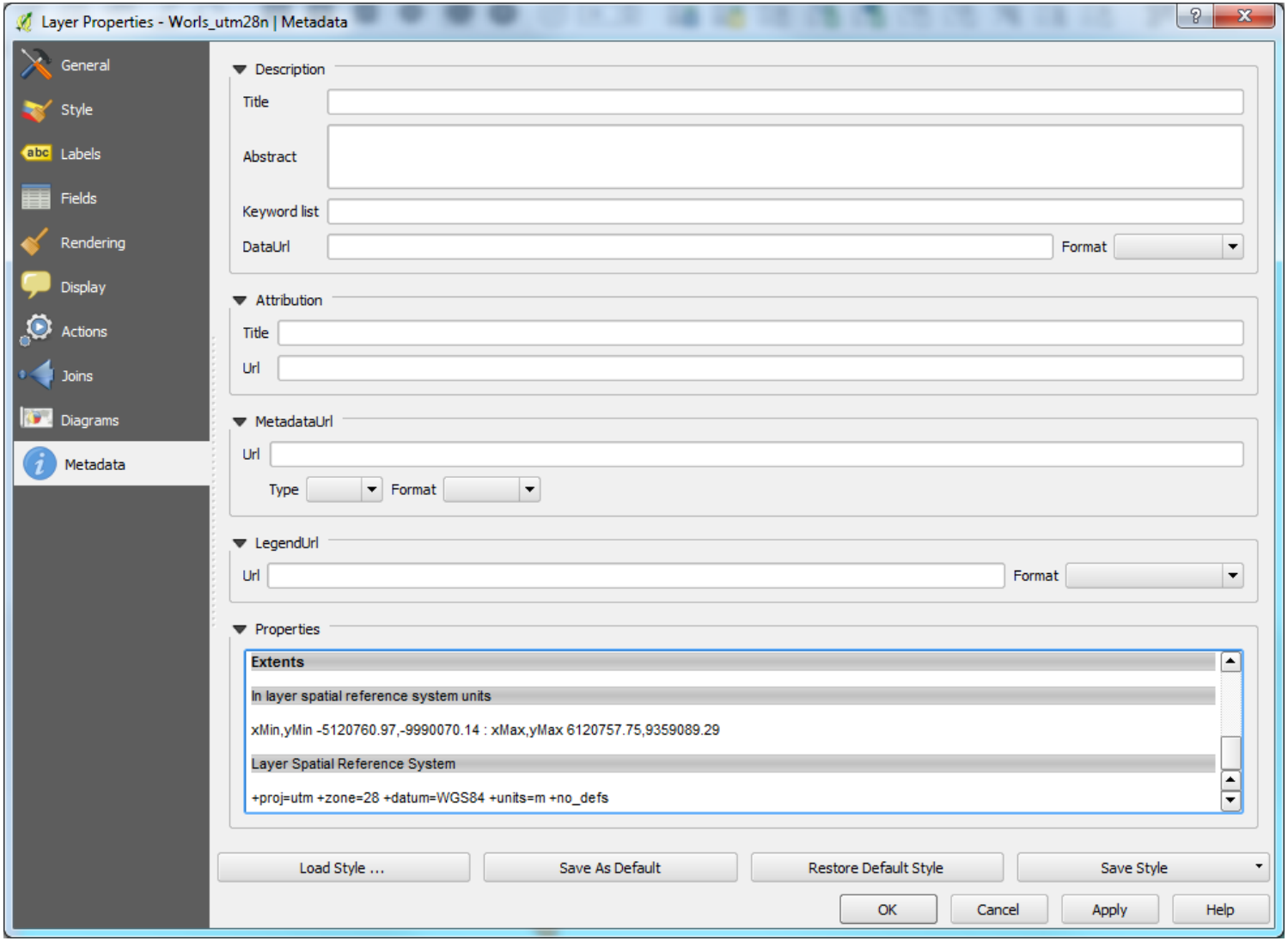
Center coordinates
500000.00 4649776.22

Projected bounds:
166021.44 0.00
534994.66 9329005.18

WGS84 bounds:
-18.0 0.0
-12.0 84.0

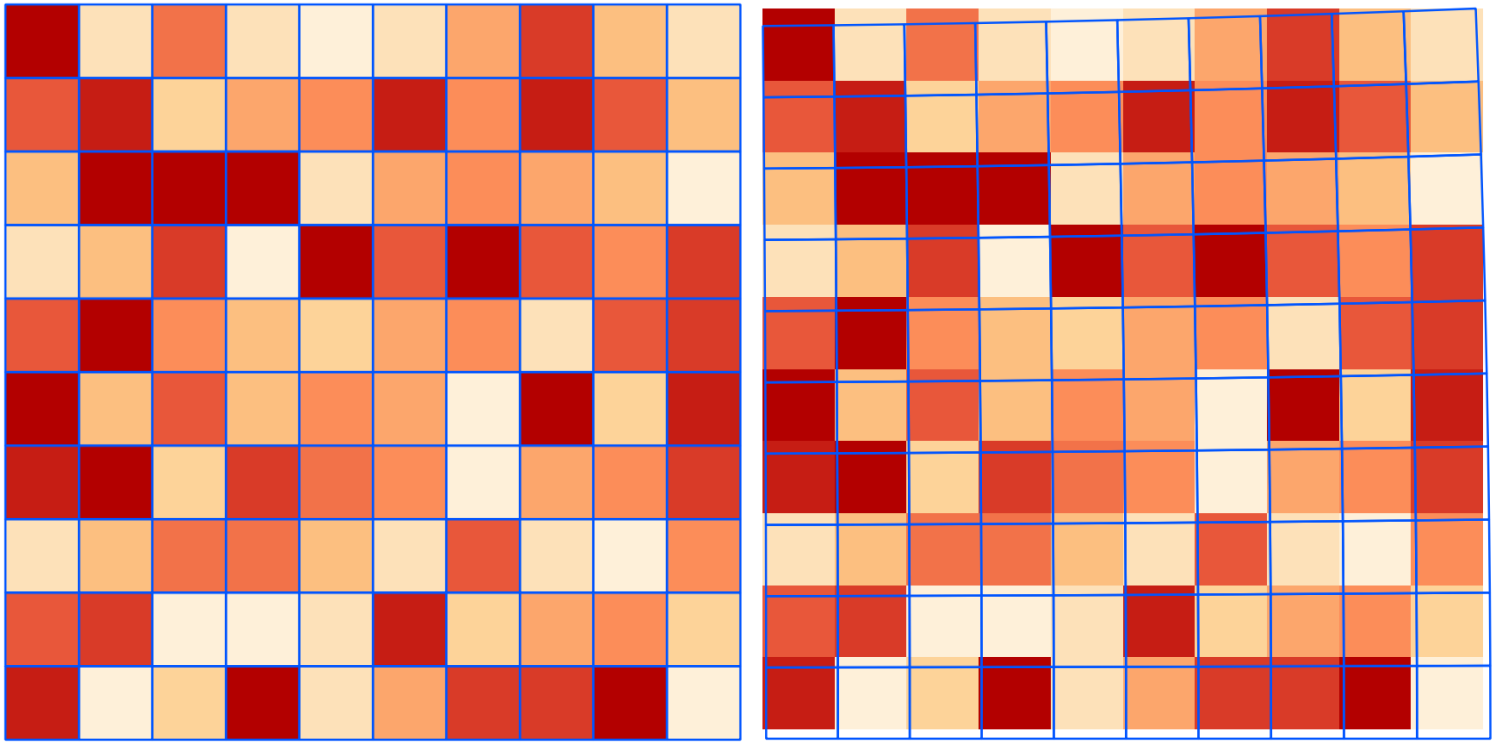
Find or define proper CRS

CRS already defined and available in metadata



Reoprojecting vectors &rasters

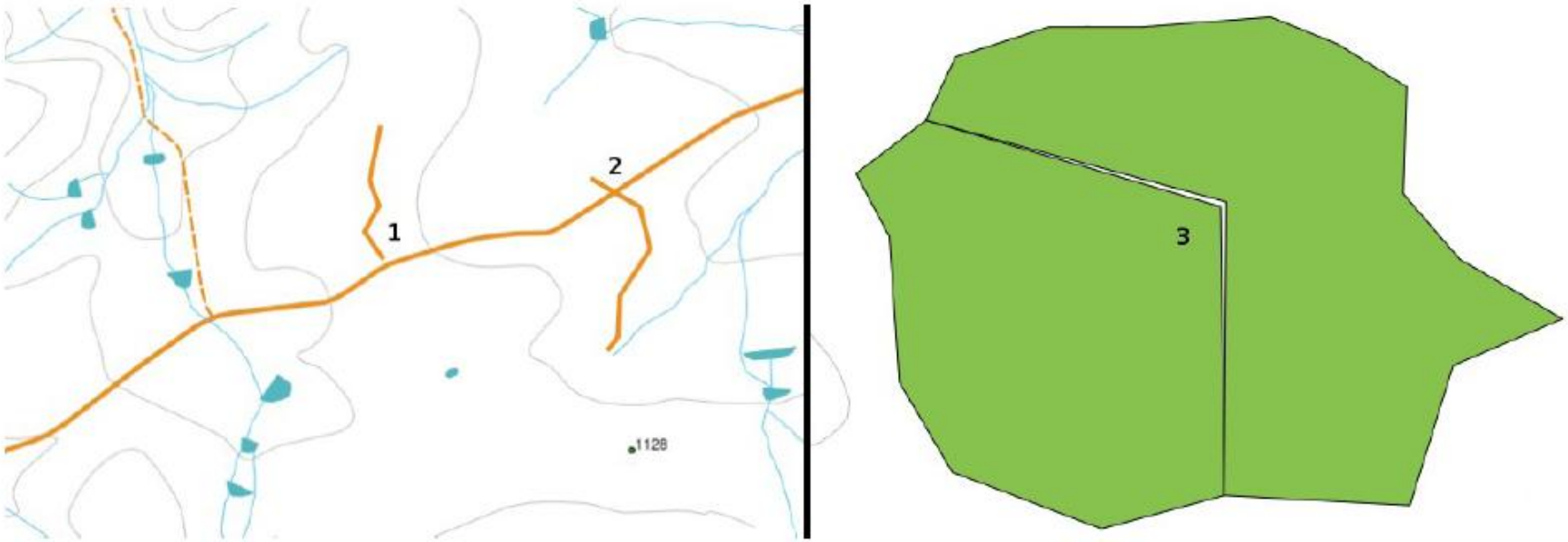
As seen previously rasters are modified when reprojected, vectors remains the same.



WGS84 UTM

Topology

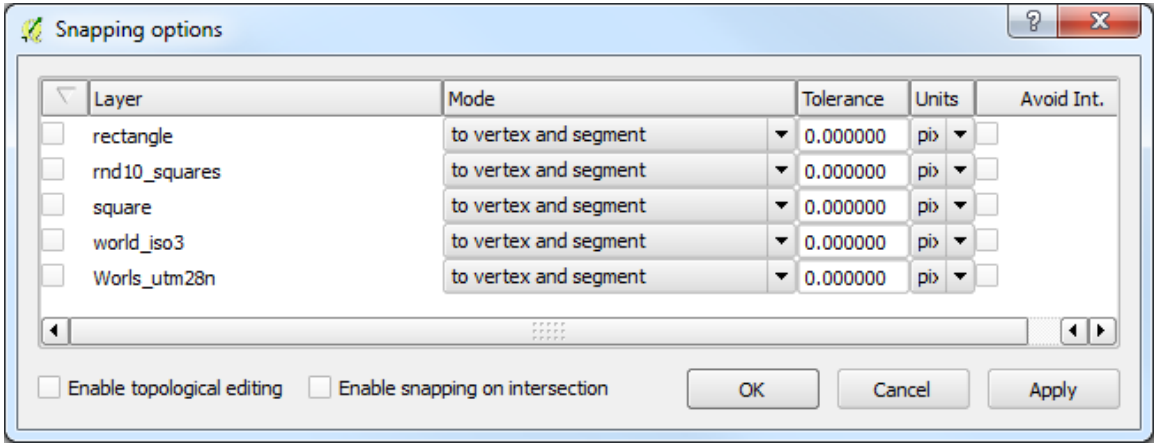
Topology expresses the spatial relationships between connecting or adjacent vector features (points, polylines and polygons) in a GIS. Topological or topology-based data are useful for detecting and correcting digitising errors (e.g. two lines in a roads vector layer that do not meet perfectly at an intersection).

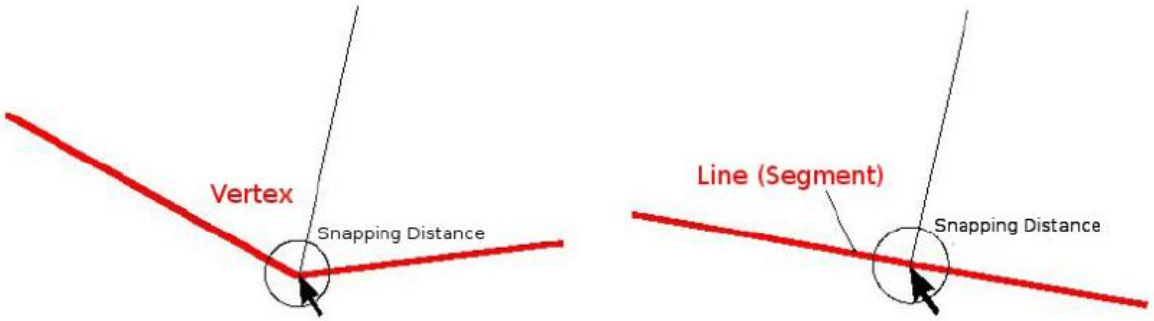


Source: http://linfiniti.com/dla/ *topology worksheet*

Topology - tools

Many GIS applications provide tools for topological editing. For example in QGIS you can enable topological editing to improve editing and maintaining common boundaries in polygon layers.

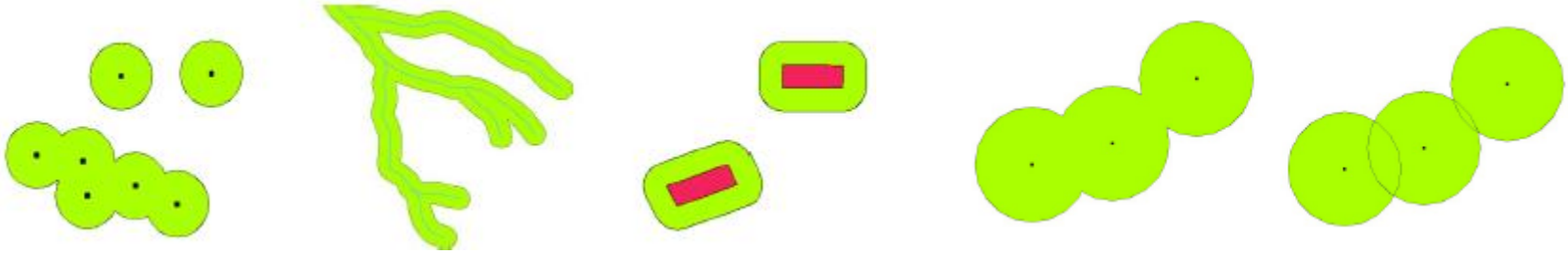




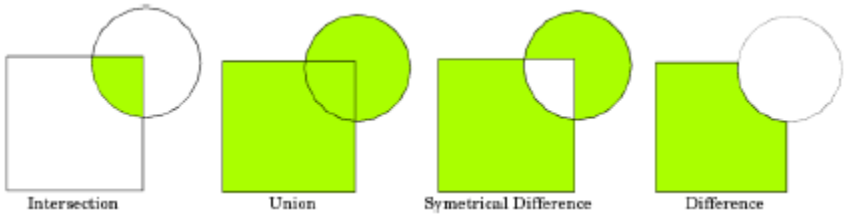
Source: http://linfiniti.com/dla/ *topology worksheet*

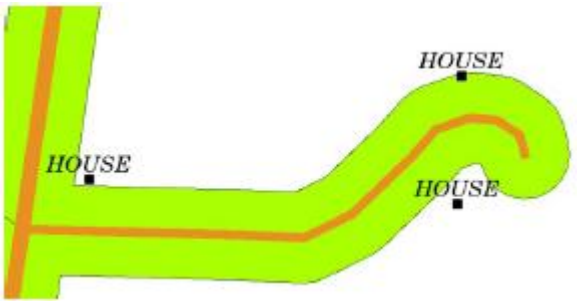
Vector processing

Buffers



Spatial overlay

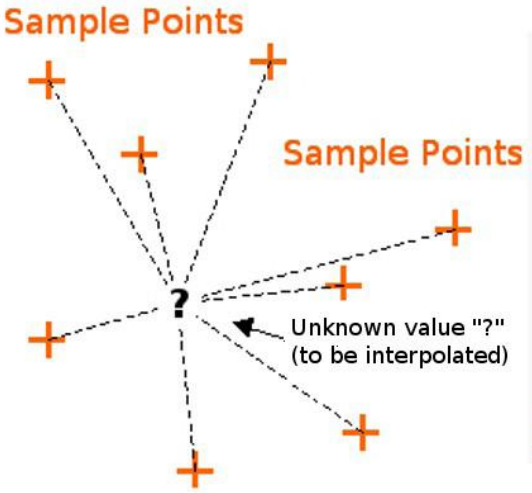


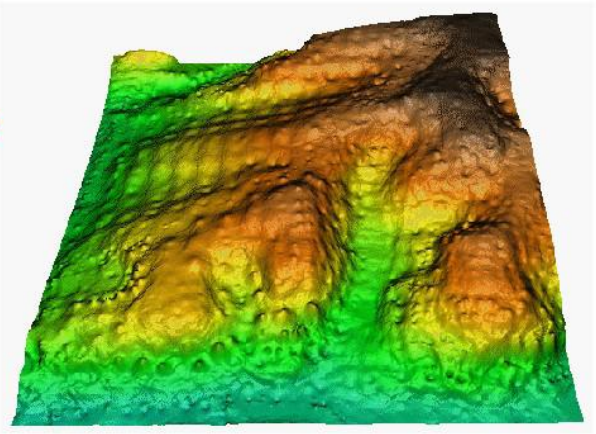


Source: http://linfiniti.com/dla/ *spatial analysis: vector data worksheet*

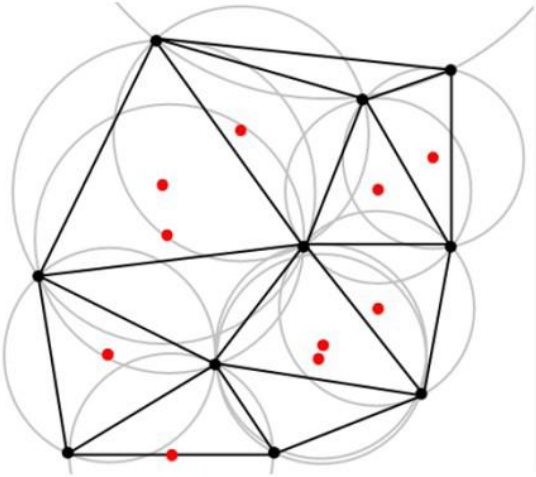
Raster interpolation

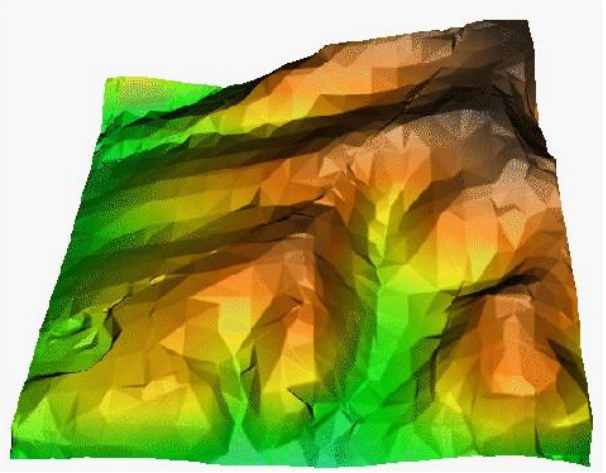
Inverse distance Weighted (IDW)





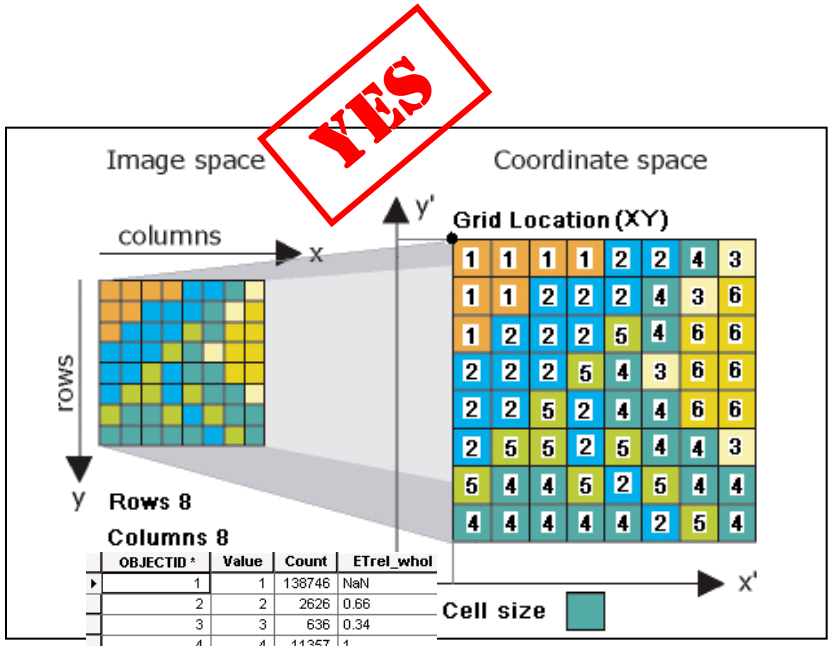
Triangulated Irregular Network (TIN)





Source: http://linfiniti.com/dla/ *spatial analysis: raster data worksheet*

To conclude



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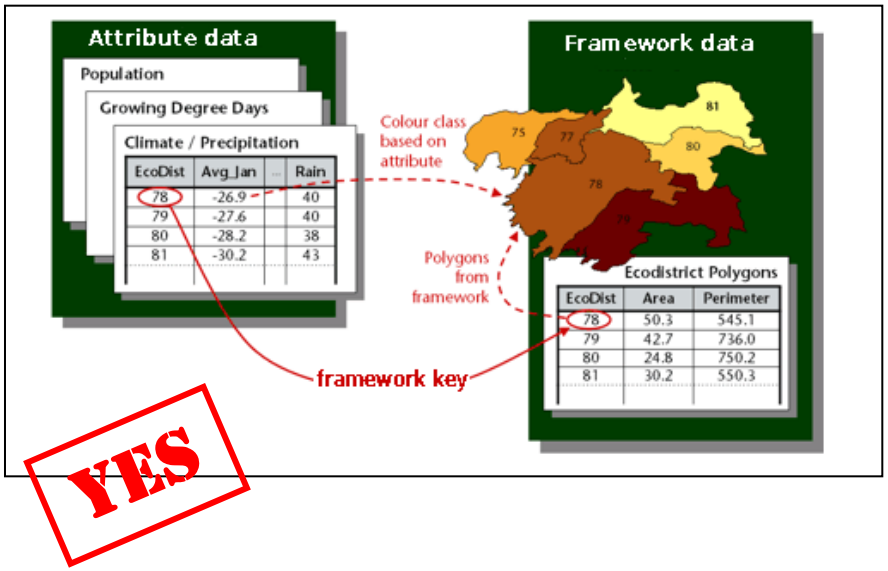
3	3	636	0.34
4	4	11357	1
5	5	3100	0.74
6	6	3932	0.84
7	7	1893	0.58
8	8	1010	0.46
9	9	3047	0.73
10	10	1112	0.48
11	11	1463	0.52
12	12	3000	0.72
13	13	984	0.45
14	14	3587	0.81
15	15	997	0.44
16	16	1720	0.56
17	17	5106	0.91
18	18	839	0.42
19	19	3829	0.82
20	20	2877	0.69
21	21	3903	0.83
22	22	4394	0.94
23	23	443	0.21
24	24	2253	0.62
25	25	3224	0.75



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