Regional training workshop on geographical information system for energy planning

Data and metadata collection guidelines

Introduction to geographic data

Dakar, 12 August 2014
Introduction to geospatial data
What do we mean by geographic data?

... any data with a geographical component, formatted to be used in a Geographical Information System and provided with proper metadata.

Synonyms: Geodata, spatial 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
Dakar is the capital and largest city of Senegal... population (2011) 2,396,800, coordinates $14^\circ \ 41' \ 34'' \ N \ 17^\circ \ 26' \ 48'' \ W$

<table>
<thead>
<tr>
<th>Name</th>
<th>Capital of</th>
<th>Pop2011</th>
<th>Latitude</th>
<th>Longitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dakar</td>
<td>Senegal</td>
<td>2,396,800</td>
<td>$14^\circ \ 41' \ 34'' \ N$</td>
<td>$17^\circ \ 26' \ 48'' \ W$</td>
</tr>
</tbody>
</table>

- 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).

<table>
<thead>
<tr>
<th>Vector Point Feature</th>
<th>Vector Polyline Feature</th>
<th>Vector Polygon Feature</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Point Geometry</strong> (indicates the x,y)</td>
<td><strong>Polyline Geometry</strong> (a series of connected vertices that do not form an enclosed shape)</td>
<td><strong>Polygon Geometry</strong> (a series of connected vertices that do form an enclosed shape)</td>
</tr>
<tr>
<td><img src="image" alt="Vector Point Feature Diagram" /></td>
<td><img src="image" alt="Vector Polyline Feature Diagram" /></td>
<td><img src="image" alt="Vector Polygon Feature Diagram" /></td>
</tr>
<tr>
<td><strong>Point attributes</strong> (describe the feature)</td>
<td><strong>Polyline attributes</strong> (describe the feature)</td>
<td><strong>Polygon attributes</strong> (describe the feature)</td>
</tr>
<tr>
<td><strong>Id, Name, Description</strong></td>
<td><strong>Id, Name, Description</strong></td>
<td><strong>Id, Name, Description</strong></td>
</tr>
<tr>
<td>1, Tree, Outside our classroom</td>
<td>1, Footpath 1, From class to the playground</td>
<td>1, School Boundary, Fenceline for the school</td>
</tr>
<tr>
<td>2, Light post, At the school entrance</td>
<td>2, Footpath 2, From the school gate to the hall</td>
<td>2, Sports Field, We play soccer here</td>
</tr>
</tbody>
</table>

Source: [http://linfiniti.com/dla/ vector data worksheet](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.
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!

- Pixels size modified
- Pixels values modified
- Shifted pixels
- 0 became nodata

Pixel size: 1.00, 1.00
Pixel size: 0.95, 1.02
Coordinate Reference Systems (CRS)

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

Map Projection Families

- **Cylindrical**
- **Conical**
- **Planar**

Source: [http://linfiniti.com/dla/ coordinate reference systems worksheet](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.
Find or define proper CRS

http://epsg.io

Define proper CRS

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
5000000.00 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
Reprojecting vectors & rasters

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

Sample Points

Unknown value "?" (to be interpolated)

Triangulated Irregular Network (TIN)

To conclude...
Thanks

www.grid.unep.ch

bruno.chatenoux@unepgrid.ch