

Geographic Information Systems

ISA, 2013-2014

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GIS Project

The students can do the work in groups up to two students. The output of the work should be delivered in the following format:

1. For each Part of the project, a set of output files; the name of each file should match the layer name in QGIS and the name of the dataset in the diagrams that describe the spatial operations (see below); students should include a QGIS project file for each Part, located in the corresponding folder; the files should be grouped in a **pen**.
2. A **hardcopy** (printed on paper) of a concise report, with the names of the students. The report should include complete **operation diagrams** similar to the ones done in class (see class slides) to describe the operations that were used to address each problem. The report can also include short notes to clarify any aspects of the work, and comments about the results on each Part of the project.

Deadline: May 23, 2014

Available Data

The data are from “Paisagem Protegida da Serra de Montejunto” (PPSM), a Portuguese protected area created in 2009, and are available in the folder \\dspace\home\cadeiras\sig\2013-2014\project

- o The polygon dataset LandCoverLimit indicates an area where a Land Cover map is to be established;
- o The point dataset LandCoverExamples gives some examples of land cover for some points within LandCoverLimit;
- o The datasets ElevationPoints (with numeric attribute Elevation, in meters), WaterStreamsZ (with Z-coordinates in meters), and ContourLines (with numeric attribute ELEVATION in meters) describe the relief of the area;
- o The polygon dataset LimitDEM indicates the limit of the area where a Digital Elevation Model is to be derived from the previous datasets;
- o The polygon dataset LimitPPSM indicates the limits of the protected area;
- o The line dataset RoadNetwork contains the location of main roads and paths. The dataset table has attribute type with domain {“road”, “path”};
- o The polygon dataset COS_2007 with coarse information on the land cover of PPSM (up to the level 2 legend); it has attribute COSN2[string; 3] that contains the level 2 land cover code.

The CRS of the project and new spatial datasets to be produced is ETRS89-TM-PT06 (EPSG 3763).

Part I – Database design and editing

The goal of this part of the work is to create a land cover map for the area delimited by LandCoverLimit, using the 2006 Corine Land Cover (CLC) Legend available at http://www.eea.europa.eu/data-and-maps/data/corine-land-cover-2000/corine-land-cover-classes-and/clc_legend.csv. The CLC legend has three levels. Digitalize the land parcels over a fine resolution satellite image (available through the Plugin OpenLayers) trying to establish the land cover down to level 3. Organize your database tables (spatial or non-spatial) to avoid relevant redundancies; furthermore, the spatial dataset you create should be topologically consistent.

Using the GIS datasets you obtained, answer to the following question: Supposing that the average annual tax per ha is given by the following table, determine the total annual tax collected within the area delimited by LandCoverLimit.

Level 2 of CLC Legend	Annual tax (euros/ha)
Urban fabric	100
Mine, dump and construction sites	10
Arable land	20
Permanent crops	30
Pastures	10
Heterogeneous agricultural areas	15
Forests	10
Scrub and/or herbaceous vegetation associations	5
Open spaces with little or no vegetation	5

Part II – relief

This part of the work is done in the area delimited by LimitDEM. The goals of the analysis are the following: create a digital elevation model from the available topographic information; convert this into a vector hypsometric map with 4 elevation classes; compare for the study area the digital elevation model above with the global elevation model “ASTER GLOBAL DEM”.

1. Use the datasets ContourLines, ElevationPoints and WaterStreamsZ to obtain a digital elevation model with a spatial resolution of 5m; call the output DEM5aux;

2. Be sure that DEM5 is in GeoTIFF format; otherwise, save it in GeoTIFF format. Clip DEM5aux with LimitDEM (hint: use the clipper tool) to obtain an output DEM5 which will be just defined over the area of LimitDEM (you can change the background in Properties/Transparency);
3. From DEM5 derive a hypsometric map of elevations, i.e. a polygon vector dataset with four elevation classes. The classes are: elevation up to 250m;]250m,300m],]300m,350m], and elevation higher than 350m. Call the output ElevationClasses;
4. From <http://earthexplorer.usgs.gov/> download the digital elevation model “ASTER GLOBAL DEM” for the area of interest. Compare the elevations given by ASTER GLOBAL DEM with the elevation given by DEM5 at the same resolution; include in your report a histogram of the differences and comment on it.
5. Using the vector dataset ElevationClasses, indicate the average difference between DEM5 and ASTER GLOBAL DEM for each of the four elevation classes; discuss the results.

Part III – spatial analysis

The goal of this part of the project is to define a map of “Paisagem Protegida da Serra de Montejunto” (delimited by LimitPPSM) according to levels of environment protection. Several levels of protection are considered, from the most restrictive (Level 1) to the least restrictive (Level 4: no protection). When the same location satisfies more than one criteria, the level of higher protection should be retained.

The output should be a polygon vector dataset with the indication of the level of protection for each polygon, and should be presented as a map with a legend indicating (1) the level of protection and (2) the total area for each level.

Protection levels and criteria:

Level 1 (Eagle protection). Sites that satisfy simultaneously the following conditions – (1) areas above 300m and (2) areas where the slope in a radius of 25m is higher than 70% (hint: use a circular majority filter with a radius of 25m and a 0% threshold), -- are adequate for nesting of eagles. From the resulting selected spatial sites, only the ones with a continuous area larger than 5000m² should be considered for eagle protection.

Level 2 (Other wildlife protection). Forested areas (i.e. as indicated by COSN2 code 3.1 or 3.2 in the polygon vector dataset COS2007) and heterogeneous agricultural areas (code 2.4) adjacent to forested areas.

Level 3 (Low protection). All the areas that (1) are not in level 1 or 2; (2) are not artificial areas (codes 1.1, 1.2 or 1.3 in COS2007) and (3) are not in the vicinity of paths and roads. The vicinity corresponds to a distance of 15 meters for paths and 30 meters for roads.

Level 4 (No protection): Remaining areas (i.e. artificial areas or vicinity of paths and roads as defined in level 3).