Using Vegetation Maps to Provide Information on Soil Distribution

Juan José Ibáñez[1], Rufino Pérez-Gómez[2], Eric C. Brevik[3], and Artemi Cerdà[4]

1 –National Museum of Natural History, Spanish National Research Council (CSIC), Madrid, Spain 2 – Departamento de Ingeniería Topográfica y Cartografía, Universidad Politécnica de Madrid (UPM), Madrid, Spain 3 –Dept. of Natural Sciences, Dickinson State University, USA 4 – Departament de Geografia, Universitat de València, Valencia, Spain

Introduction

- Many different types of maps (geology, hydrology, soil, vegetation, etc.) are created to inventory natural resources
- Each of these resources is mapped using a unique set of criteria, including scales and taxonomies
- Past research has indicated that comparing the results of different but related maps (e.g., soil and geology maps) may aid in identifying deficiencies in those maps
- Therefore, this study was undertaken in the Almería Province (Andalusia, Spain) to (i) compare the underlying map structures of soil and vegetation maps and (ii) to investigate if a vegetation map can provide useful soil information that was not shown on a soil map

Materials and Methods

- The study area is part of the Almeria Province located in the south-eastern Iberian Peninsula (Figure 1)
- The river networks of the Almeria arid lands are called the ramblas, which indicates the semi-arid, arid and desertic ephemeral water (called wadi in Africa and arroyos in the western USA)
- Soil and vegetation maps were imported into ArcGIS 10.1 for spatial analysis
- Results of the spatial analysis were exported to Microsoft Excel worksheets for statistical analyses to evaluate fits to linear and power law regression models
- Data were sorted by decreasing number or spatial extent of its polygons to obtain rank-abundance plots
- Vegetative units were grouped according to the driving forces that determined their presence or absence (P/A): (i) climatophilous (climate is the only determinant of P/A) (ii); lithologic-climate (climate and parent material determine PNV P/A); and (iii) edaphophylous (soil features determine PNV P/A)

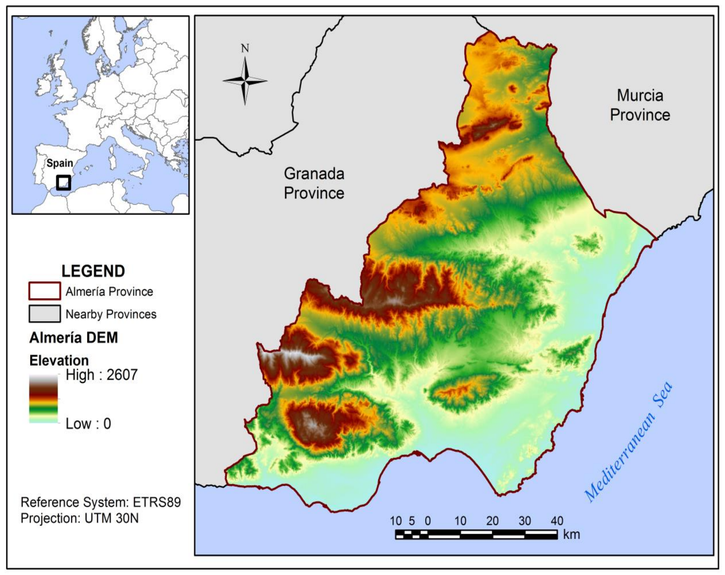

Figure 1. Digital elevation model of the study area (Almería, Spain).

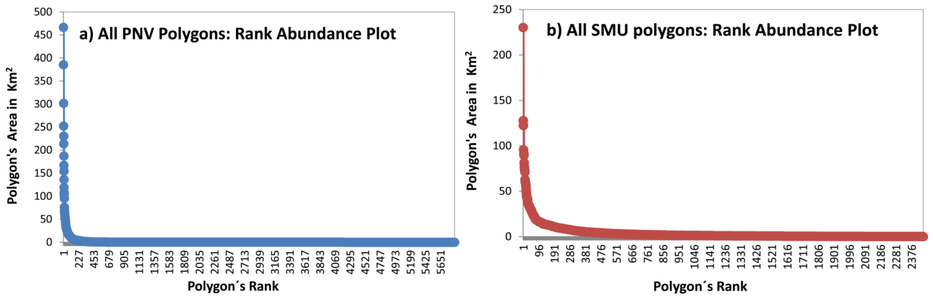

Figure 2. Rank abundance plots of (a) all the PNV polygons, and (b) all soil associations (or soil map units –SMU-) polygons.

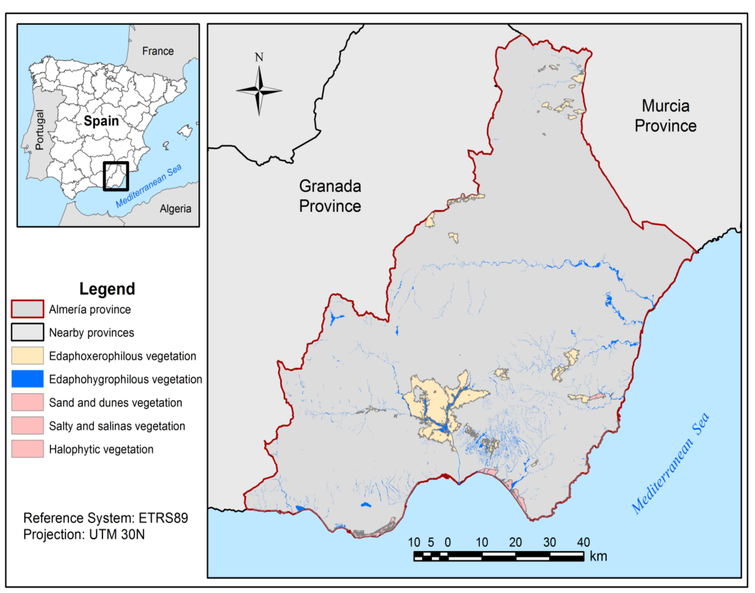

Figure 3. Distribution of edaphophylous and other related vegetation types in Almería.

Results

- The rank abundance plots for both the soil and vegetation maps conformed to Willis or Hollow Curves (Figure 2), meaning the underlying structures of both maps were the same
- Edaphophylous map units, which represent 58.5% of the vegetation units in the study area, did not show a good correlation with the soil map
- Further investigation revealed that 87% of the edaphohygrophylous units (which demand more soil water than is supplied by other soil types in the surrounding landscape) were found in ramblas, which are not typically classified and mapped as soils in modern systems, even though they meet the definition of soil given by the most commonly used and most modern soil taxonomic systems
- Only 2 (12.5%) of the edaphohygrophilous PNV are conspicuously riparian units that border the margins of the largest and wettest ramblas courses, areas that are shown as soils on soil maps , but 14 (87.5%) of these vegetation types are located in the ramblas river beds which are not considered soils on existing soil maps (Figure 3)

Discussion and Conclusions

- Several studies comparing soil and geology maps have indicated that soil maps can provide important information that is missing on the geology maps when the soil maps are at a larger scale than the geology maps
- This study gives another example of a case where a larger scale map (vegetation) provides important information that is missing from a smaller scale map (soil) showing a related natural resource
- Furthermore, the edaphophylous map units tend to be islands of biodiversity that are threatened by anthropogenic activity in the region
- This study revealed areas in Almería Province that need to be revisited and studied pedologically
- The vegetation mapped in these areas and the soils that support it are key components of the earth's critical zone that must be studied, understood, and preserved