

Exercise: Classifying the water and energy regime of sites based upon DEM and soil data

Goals:

- Learn to derive ecologically relevant data by using GIS tools
- Learn to link those variables to information derived from point surveys
- Apply multivariate statistics to classify observations into 'moisture classes'
- Derive classification functions which can be used for upscaling

Step 1: Create a GIS folder structure

/Project	/data
	/shapefiles
	/gridfiles
	/TIN
	/legends
	/protocols

Step 2: Open and customize a GIS (spatial analyst, 3D analyst)

Step 3: Open DTM data (different formats available)

Step 4: Calculate the Compound Topographic Index (CTI)

1. **Arc Toolbox – Spatial Analyst Tools → Hydrology**
→ fill (sinks) → flow direction → flow accumulation

result: Creates a grid of accumulated flow to each cell, by accumulating the weight for all cells that flow into each downslope cell.

2. **Arc Toolbox – Spatial Analyst Tools → Surface**
→ slope

3. **Spatial Analyst → Raster Calculator**
→ *calculate specific catchment area A*
(*flow accumulation * cell area / cell width*)
→ *calculate CTI = $\ln (A / \tan(\text{slope}))$*

4. (optional): smooth by using **Spatial analyst – neighborhood statistics**

Step 5: Calculate cell values for precipitation, temperature relative humidity, potential evapotranspiration etc. based upon regression derived functions (raster calculator)

Step 6: Calculate potential global radiation by using the solar radiation extension in the Spatial Analyst Toolbox

Step 7: Add the inventory data (dBase or xls file) to ArcMap 's active data frame & create event theme (pulldown ,tools → Add XYdata → *creates an event theme*)

Step 8: Add the values of all underlying rasters/grids to the event themes attribute table (Spatial Analyst → Zonal Statistics)

Step 9: Export the table to dBase

Step 10: Import the table to a statistics package (e.g. SPSS)

Step 11: Data examination (histograms, box plots, scatter plots)

Step 12: Multivariate data analysis:

- in case of correlated variables: eventually perform a PCA (factor analysis) and store PCA scores
- Calculate a cluster analysis (ev. on the PCA scores)
save group membership for the selected solution
(check dendrogram)!
- Calculate a discriminant analysis to explain group structure → interpretation as moisture classe
- Calculate logistic regression functions (probabilities of group memberships)

Step 13: Apply logistic regression functions in GIS